PROBLEMS ON CAPITAL BUDGETING-1

Solution – 6.1: Case – A

We know that when discounting rate is IRR , Present Value of future cash flows is equals to Initial Investment. So , we can say :

Initial Investment = $1,00,000 / 1.20^1 + 1,00,000 / 1.2^2 + \text{-------} + 1,00,000 / 1.2^{10}$

= 4,19,247

PI = Present value of future cash flows / Initial Investment

⇨ 1.1089 = Present value of future cash flows / 4,19,247

⇨ Present value of future cash flows = 4,64,903

NPV = Present value of future cash flows – Initial Investment

= 4,64,903 – 4,19,247 = 45,656

Let us assume that cost of capital is k. So , we can write the following :

$4,64,903 = 1,00,000 / (1+k)^1 + 1,00,000 / (1+k)^2 + \text{---------} + 1,00,000 / (1+k)^{10}$

Using trial error interpolation formula : **k** = 17.1%

Case – B

Present Value of future cash flows = 3,00,000 + 60,000 = 3,60,000

Profitability Index = 3,60,000 / 3,00,000 = 1.2

Let us assume that **Annual Cash Inflow** is x , so we can write :

$3,60,000 = x / 1.16^1 + x / 1.16^2 + \text{----------} + x / 1.16^{13}$

x = 67,386

Let us assume that Internal Rate of Return is r. So , we can write :

$3,00,000 = 67,386 / (1+r)^1 + 67,386 / (1+r)^2 + \text{----------} + 67,386 / (1+r)^{13}$

Using trial error interpolation formula : r = 20.5%

Case – C

PI = Present value of future cash flows / Initial Investment

⇨ 1.125 = Present Value of Future Cash Flows / 3,51,000

⇨ Present Value of Future Cash Flows = 3,94,875

NPV = 3,94,875 – 3,51,000 = 43,875

Let us assume that life of the project is **n** years. So , we can write the following :

$3,94,875 = 80,000 / 1.12^{1} + 80,000 / 1.12^{2} + \text{----------} + 80,000 / 1.12^{n}$

=> n = 8 years

Let us assume that IRR is r , so we can write the following :

$3,51,000 = 80,000 / (1+r)^{1} + 80,000 / (1+r)^{2} + \text{----------} + 80,000 / (1+r)^{8}$

=> r = 16%

Solution – 6.3.2: Statement of Equivalent Annual Cost of Machine A

Particulars	Year – 0	Year -1 to 3
Purchase Cost of Machine	(1,50,000)	---
Running cost after tax (80,000 X 0.65)	---	(52,000)
Tax Shield on Depn. (50,000 X 0.35)	---	17,500
CFAT	(1,50,000)	(34,500)
Discounting Factor @ 10%	1.000	2.486

Equivalent Annual Costs of Machine A = [1,50,000 X 1 + 34,500 X 2.486] / 2.486 = 94,838

Statement of Equivalent Annual Cost of Machine A

Particulars	Year – 0	Year -1 to 2
Purchase cost of Machine	(1,00,000)	---
Running cost after tax (90,000 X 0.65)	---	(58,500)
Tax Shield on Depn. (50,000 X 0.35)	---	(17,500)
CFAT	(1,00,000)	(76,000)
Discounting Factor @ 10%	1.000	1.735

Equivalent Annual Costs of Machine B = [1,00,000 X 1 + 76,000 X 1.735] / 1.735 = 1,33,637

Decision: Machine A would be better than Machine B , due to lower Equivalent Annual Cost.

Solution – 6.3.3: Statement of Equivalent Annual Cost of Existing Machine

Particulars	Year-0	Year-1 to 5
Repair after tax (19,000 X 0.5)	(9,500)	---
Running costs after tax (20,000 X 0.5)	---	(10,000)
CFAT	(9,500)	(10,000)
Discounting Factor @ 10%	1.000	3.790

Equivalent Annual Costs of Existing Machine = (9,500 X 1 + 10,000 X 3.79) / 3.79 = 12,507

Statement of Equivalent Annual Cost of New Machine

Particulars	Year-0	Year-1 to 10
Purchase cost of new Machine	(49,000)	---
Sale of existing machine	5,000	---
Running costs after tax (14,000 X 0.5)	---	(7,000)
Tax Shield on Depreciation [(49,000 / 10) X 0.5]	---	2,450
CFAT	(44,000)	(4,550)
Discounting Factor @ 10%	1.000	6.144

Equivalent Annual Cost of New Machine = [44,000 X 1 + 4,550 X 6.144] / 6.144 = 11,711

Decision: Old machine should be replaced by the new one.

Solution – 6.4.2:

a)

Project	PI	Rank	Fund Allocation	NPV
A	1.100	2	1,00,000	11,000
B	1.106	1	1,50,000	16,000
C	1.043	5		
D	1.075	3	40,000	3,000
E	1.067	4	30,000	2,000
			3,20,000	32,000

b) Optimum Investment Package out of A, B , C and D is :

A , B , D & $3/7^{th}$ of C having NPV = Rs.(11,000 + 16,000 + 3,000 + 3,000 X 3 / 7) = Rs.31,286

Optimum Investment Package out of A, B , C and E is :

A , B , E & $1/7^{th}$ of C having NPV = Rs.(11,000 + 16,000 + 4,000 + 3,000 X 1 / 7) = Rs.31,286 = Rs.31,429

So , optimum investment package would be A , B , E & $1/7^{th}$ of C. due to higher NPV.

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Solution – 6.4.3:

NPV (A) = 6,695

NPV (B) = 6,265

NPV (C) = 16,680

NPV (D) = 5,755

NPV (E) = 13,910

As all the projects are profit making and there is no limitation of fund , all the projects should be accepted.

In case of limitation of fund the following points are important:

- Project D should be accepted always as it has positive NPV and at the time of fund requirement there is no limitation of fund. Our choice would be out of A , B , C and E.
- The choice should be based on Profitability Index as follows:

Project	PI	Rank	Fund Allocation	NPV
A	1 + 6695/60,000 = 1.11	4	—	—
B	1 + 6265/30,000 = 1.21	3	10,000	6265/3 = 2088
C	1 + 16680/40,000 = 1.42	1	40,000	16,680
E	1 + 13910/50,000 = 1.28	2	50,000	13,910

Solution – 13.16:

Year	CFAT	DF @ 16%	Present Value
1	x	0.862	0.862x
2	x	0.743	0.743x
3	x	0.641	0.641x
4	x	0.552	0.552x
5	x	0.476	0.476x
6	1,00,000 + x	0.410	41,000 + 0.41x
			41,000 + 3.684x

$$\text{Duration} = \frac{0.862x \times 1 + 0.743x \times 2 + 0.641x \times 3 + 0.552x \times 4 + 0.476x \times 5 + [41{,}000 + 0.41x] \times 6}{41{,}000 + 3.684x}$$

$$\Rightarrow 4.3202 = \frac{2{,}46{,}000 + 11.319x}{41{,}000 + 3.684x}$$

$\Rightarrow 1{,}77{,}128 + 15.9156x = 2{,}46{,}000 + 11.319x$

$\Rightarrow 4.5966x = 68{,}872$

$\Rightarrow x = 14{,}983$

So , value of the bond = 41,000 + 3.684 X 14,983 = 96,197