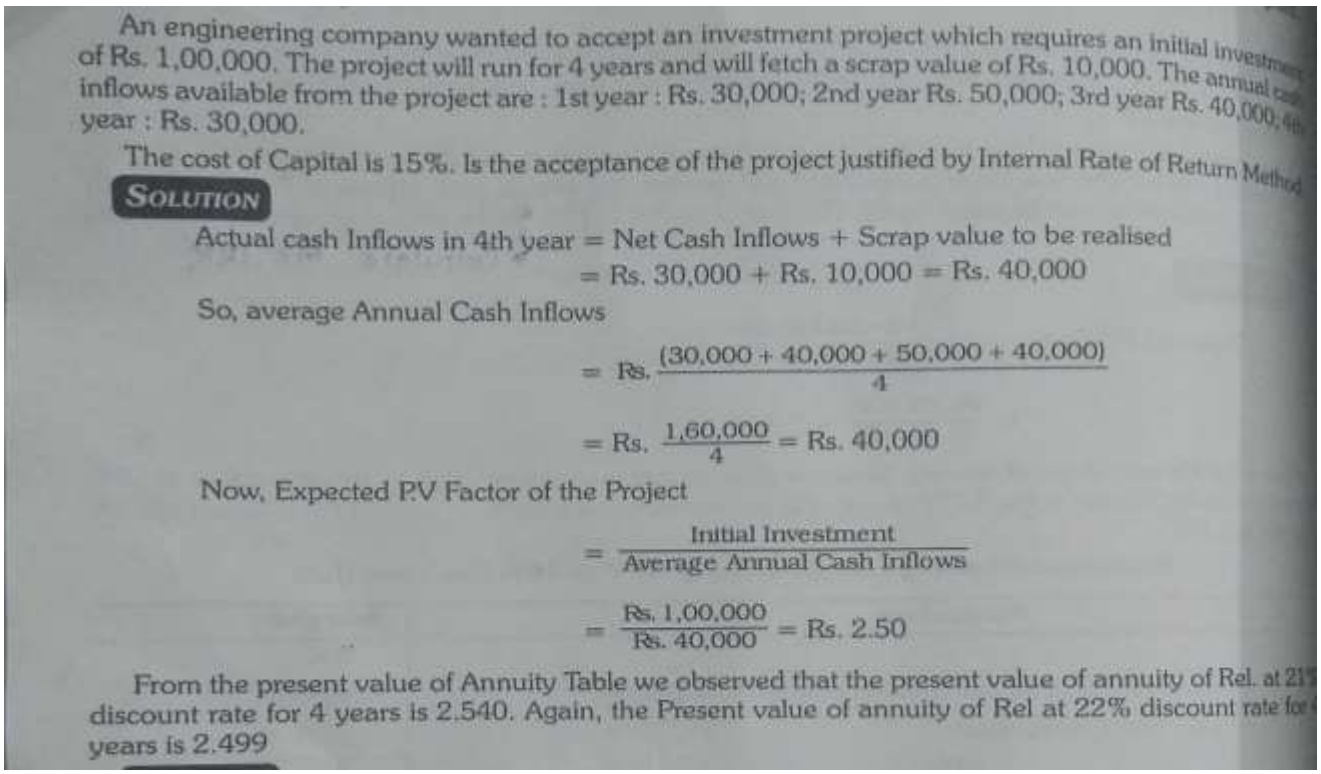
IRR (CRITICAL SUM)

PROBLEM



An engineering company wanted to accept an investment project which requires an initial investment of Rs. 1,00,000. The project will run for 4 years and will fetch a scrap value of Rs. 10,000. The annual cash inflows available from the project are : 1st year : Rs. 30,000; 2nd year Rs. 50,000; 3rd year Rs. 40,000; 4th year : Rs. 30,000.

The cost of Capital is 15%. Is the acceptance of the project justified by Internal Rate of Return Method

SOLUTION

Actual cash Inflows in 4th year = Net Cash Inflows + Scrap value to be realised
= Rs. 30,000 + Rs. 10,000 = Rs. 40,000

So, average Annual Cash Inflows

$$= \text{Rs.}\ \frac{(30,000 + 40,000 + 50,000 + 40,000)}{4}$$

$$= \text{Rs.}\ \frac{1,60,000}{4} = \text{Rs. } 40,000$$

Now, Expected P.V Factor of the Project

$$= \frac{\text{Initial Investment}}{\text{Average Annual Cash Inflows}}$$

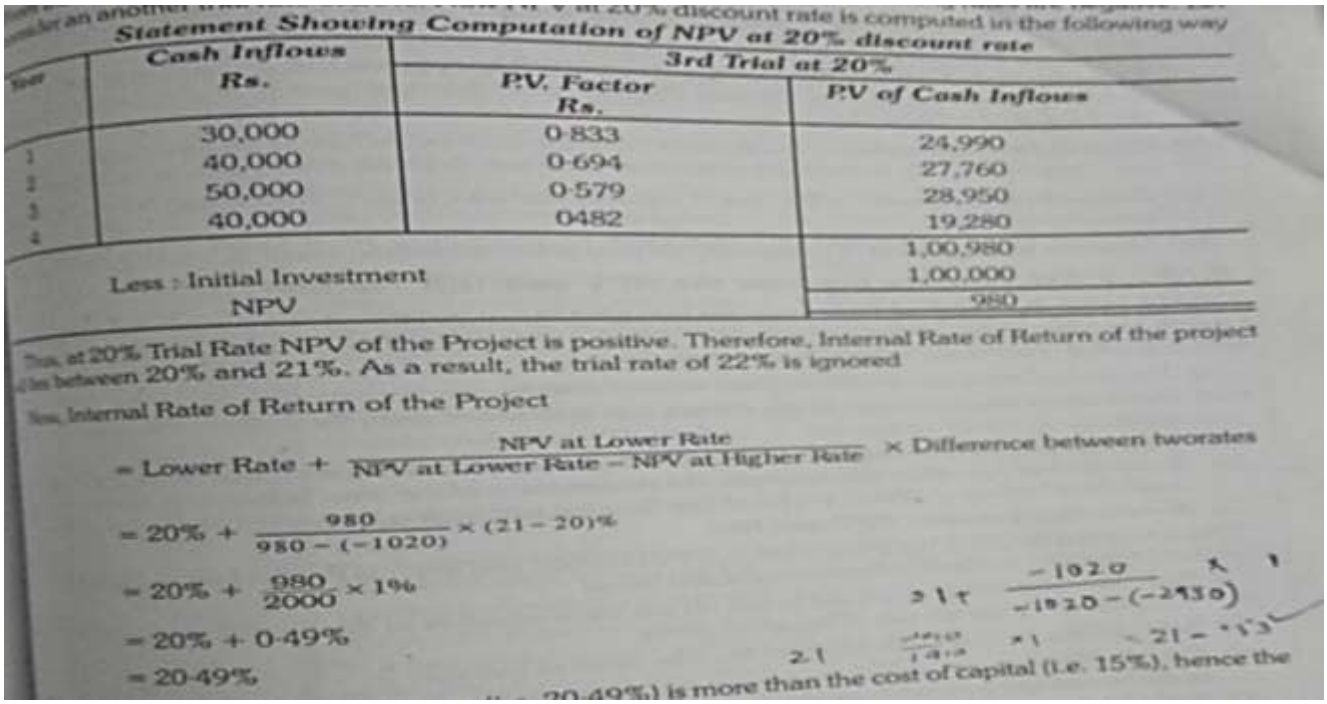
$$= \frac{\text{Rs. } 1,00,000}{\text{Rs. } 40,000} = \text{Rs. } 2.50$$

From the present value of Annuity Table we observed that the present value of annuity of Rel. at 21% discount rate for 4 years is 2.540. Again, the Present value of annuity of Rel at 22% discount rate for 4 years is 2.499

Statement showing computation of NPV at 21%and 22% discount rates

year	Cash inflows	Trial at 21%		TRIAL AT 22%	
		pvf	Pv of cash inflows	pvf	Pv of cash inflows
1	30000	.826	24780	.820	24600
2	40000	.683	27320	.672	26880
3	50000	.564	28200	.551	27550
4	40000	.467	18680	.451	18040
			98980		97070
Less- initial investment			100000		100000
NPV			(1020)		(2930)

From the above table we see, NPV both at 21%and 22% discount rates are negative. Let us consider another trial rate of 20%.



Statement Showing Computation of NPV at 20% discount rate is computed in the following way

Year	Cash Inflows Rs.	3rd Trial at 20% P.V. Factor Rs.	3rd Trial at 20% P.V of Cash Inflows
1	30,000	0·833	24,990
2	40,000	0·694	27,760
3	50,000	0·579	28,950
4	40,000	0482	19,280
			1,00,980
	Less : Initial Investment		1,00,000
	NPV		980

Thus, at 20% Trial Rate NPV of the Project is positive. Therefore, Internal Rate of Return of the project lies between 20% and 21%. As a result, the trial rate of 22% is ignored

Now, Internal Rate of Return of the Project

$$= \text{Lower Rate} + \frac{\text{NPV at Lower Rate}}{\text{NPV at Lower Rate} - \text{NPV at Higher Rate}} \times \text{Difference between two rates}$$

$$= 20\% + \frac{980}{980 - (-1020)} \times (21 - 20)\%$$

$$= 20\% + \frac{980}{2000} \times 1\%$$

$$= 20\% + 0{\cdot}49\%$$

$$= 20{\cdot}49\%$$

Since the IRR of 20.49% is higher than the cost of capital of 15%, the project will be accepted.

MODIFIED INTERNAL RATE OF RETURN

R Modified Internal Rate of Return (MIRR) Method

The discount rate which equates the present value of the terminal cash inflow to the zeroth year cash outflow, is called the **Modified Internal Rate of Return (MIRR).** In this case,Terminal cash inflow or Terminal value refers to the compound value of the cash inflows from a project until the termination of the project. The procedure for determining the **MIRR** of a project is given below :

Step - I ⇒ The present value of cash outflow **(PVC)** of the project is to be determined.

Step - II ⇒ The terminal value **(TV)** of the cash inflows expected from the project is to be determined by using the cost of capital (Or, *same other explicit rate, if given*).

Step - III ⇒ The **MIRR** is to be determined by applying the following formula :

$$PVC = \frac{TV}{(1+r)^n}; \text{ where—}$$

r = MIRR and n = No. of years

❑ **Example 27 :** A project requires an initial investment of ₹ 1,22,100 and a further investment of ₹ 80,000 at the end of the first year. No inflow of cash will be taken place in the first year but the project will generate the following cash inflows in the subsequent years :

At the end of	:	2nd Year	3rd year	4th year	5th year	6th year
Cash inflows (₹)	:	20,000	60,000	80,000	1,00,000	1,20,000

If cost of Capital (K) is 15%, calculate modified internal rate of return.

Given :

Year	:	1st	2nd	3rd	4th	5th	6th
PVF at 15%	:	0.870	0.756	0.658	0.572	0.497	0.432
CVF at 15%	:	1.150	1.322	1.521	1.749	2.011	2.313
CVF at 16%	:	1.160	1.346	1.561	1.811	2.100	2.436

• **Solution** ⇒ Present value of cash outflow (PVC)

$$= ₹\ 1,22,100 + \left\{80,000 \times \frac{1}{(1+0.15)^1}\right\}$$

$$= ₹\ 1,22,100 + (80,000 \times 0.870) = ₹\ (1,22,100 + 69,600) = ₹\ 1,91,700$$

Terminal value of cash inflow (TV)

$$= 20,000\ (1 + 0.15)^4 + 60,000\ (1 + 0.15)^3 + 80,000\ (1 + 0.15)^2 + 1,00,000\ (1 + 0.15)^1 + 1,20,000\ (1 + 0.15)^0$$

$$= (20,000 \times 1.749) + (60,000 \times 1.521) + (80,000 \times 1.322) + (1,00,000 \times 1.150) + (1,20,000 \times 1)$$

$$= 34,980 + 91,260 + 1,05,760 + 1,15,000 + 1,20,000 = ₹\ 4,67,000.$$

..., the Modified Internal Rate of Return will be that value of r which satisfies the following ...ion —

$$PVC = \frac{TV}{(1+r)^6} \quad \text{or,} \quad 1,91,700 = \frac{4,67,000}{(1+r)^6}$$

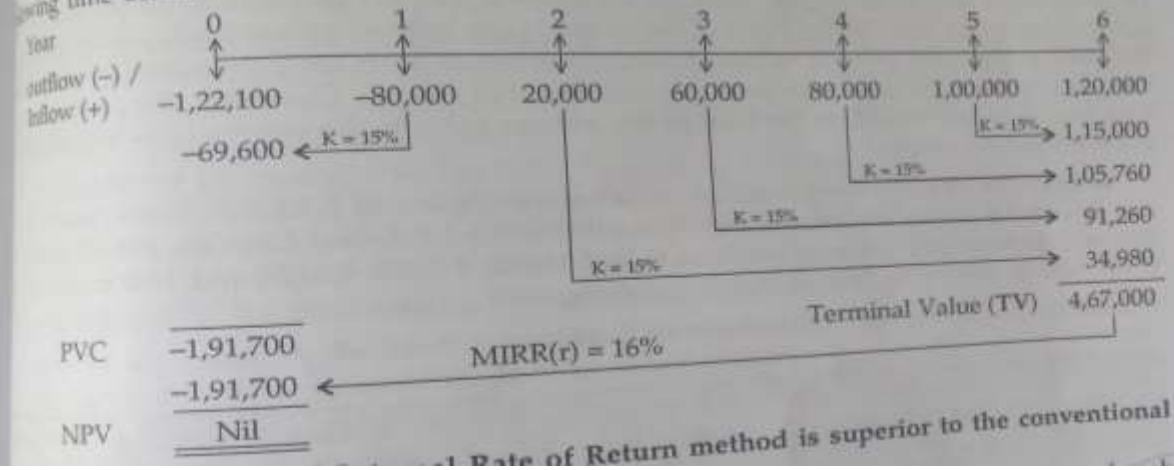
$$\text{or,} \quad (1+r)^6 = \frac{4,67,000}{1,91,700}$$

$$\text{or,} \quad (1+r)^6 = 2.436$$

... is found from the given CVF that when r = 16%, $CVF_{r,6} = 2.436$. Thus, r = 16%.

... Required Modified Internal Rate of return is 16%.

... In order to get a clear concept about the MIRR, the students are advised to note the ...wing time scale.



... Rate of Return method is superior to the conventional