LESSON - 4

CAPITAL BUDGETING: UNDER CERTAINTY

4.0 OBJECTIVES :

The objectives of this lesson are to :

1) make the students familiar about investment criterion.
2) impart knowledge about various techniques for appraisal of investment decisions..
3) make realise the importance of time value of money.
4) inculcate the skill of choosing projects under capital rationing.

STRUCTURE

4.1. INTRODUCTION:

In the previous lesson you have studied about the nature, meaning and importance of capital budgeting. It is also explained about the types and process of capital budgeting decision making. The estimation of cash flows which is a pre requisite for evaluating the projects was also explained. This lesson is devoted to explain the methods of capital budgeting both traditional and discounted cash flow techniques with merits, demerits and their applicability. At the end the conpcet of capital ratining also discussed.

4.2 INVESTMENT CRITERION - METHODS OF APPRAISAL

The capital budgeting appraisal methods or techniques for evaluation of investment proposals will help the company to decide the desirability of an investment proposal, depending upon their relative income generating capacity and rank them in order of their desirability. These methods provide the company a set of norms on the basis of which, either it has to accept or reject the investment proposal. Therefore, a sound appraisal method should enable the company to measure the real worth of the investment proposal. The appraisal methods should posses several good characteristics, which are mentioned as under.

Characteristics of a Sound Appraisal Method

i). It should help the company to rank the investment proposals in order of their desirability.

ii). It should provide a technique for distinguishing between an acceptable and non-acceptable project.

iii). It should provide a criteria to solve the problem of choosing among alternative projects.

iv). It should recognise the importance of time value of money i.e., bigger benefits are preferable to smaller ones and early benefits are preferable to later benefits.

v). It should provide the criteria for the selection of investment proposals.

vi). It should take into account the pattern of cash flows.

The criteria for the appraisal of investment proposals are grouped into two types :

A. Traditional methods
   - i) Pay Back Period Method
   - ii) Accounting or Average Rate of Return (ARR)

B. Time-adjusted or discounted cash flow Techiqurs
   - i) Net Present Value (NPV)
   - ii) Internal Rate of Return (IRR)
   - iii) Profitability Index (PI)
   - iv) Discounted payback method

4.3 TRADITIONAL METHODS :

These methods are based on the principles to determine the desirability of an investment project on the basis of its useful life and expected returns. These methods depend upon the accounting information

available from the books of accounts of the company. These will not take into account the concept of 'time value of money' which is a significant factor to determine the desirability of a project in terms of present value.

4.3.1 Pay-back Period :

It is the most popular and widely recognised traditional method of evaluating the investment proposals. It can be defined as "the number of years required to recover the original capital invested in a project". According to Weston and Brigham, "the pay back period is the number of years it takes for the firm to recover its original investment by net returns before depreciation, but after taxes". It can be calculated with the help of the following formula :

$$\text{Pay back period} = \frac{\text{Cash oulay}}{\text{Annual cash inflows}}$$

The pay back period can be used as an accept or reject criterion as well as a method of ranking projects. The pay back period is the number of years to recover the investment made in a project. If the pay back period calculated for a project is less than the maximum pay back period set - up by the company, it can be accepted. As a ranking method it gives the highest rank to a project which has the lowest pay back period, and the lowest rank to a project with the highest pay back period. Whenever a company faces the problem of choosing among two or more mutually exclusive projects, it can select a project on the basis of pay back period, which has shorter period than the other project.

Merits : The following are the merits of the pay back period method.

i. **Easy to caliculate** : It is one of the easiest methods of evaluating the investment projects. It is simple to understand and easy to compute.

ii. **Knowledge** : The knowledge of pay back period is useful in decision-making, the shorter the period better the project.

iii. **Protection from loss due to obsolescence:** This method is very suitable to such industries where mechanical and technical changes are routine practice and hence, shorter pay back period practice avoid such losses.

iv. **Easily availability of information :** It can be computed on the basis of accounting information, what is available from the books.

Demerits: However, the pay back period has certain demerits:

i). **Failure in taking cash flows after payback period :** This methods is not taking into account the cashflows received by the company after the pay back period;

ii). **Not considering time the value of money:** It does not take into account the time value of money;

iii). **Non-consideration of interest factor:** It does not take into account the interest factor involved in the capital outlay.

iv). **Maximisation of market value not possible**: It is not consistent with the objective of maximising the market value of the share;

v). **Failure in taking magnitude and timing of cash inflows:** It fails to consider the pattern of cash inflows i.e., the magnitude and timing of cash inflows.

a) When cash flows are uniform : If the proposed project's cash inflows are uniform the following formula can be used to calulate the pay back period.

$$\text{Pay back period} = \frac{\text{Initial Investment}}{\text{Annual cash inflows}}$$

Example 1 A project requires an initial investment of Rs.1,00,000/- with an useful life of 5 years. The projected cash inflows after tax (CFAT) are as follows.

Year	1	2	3	4	5
CFAT	Rs.40,000	Rs.40,000	Rs.40,000	Rs.40,000	Rs.40,000

Calculate pay back period.

Solution:-

Since the cashflows of the project are uniform for all the years payback period may be computed by using the following formula.

$$\text{Pay back period} = \frac{\text{Initial Investment}}{\text{Annual cashflow}} = \frac{\text{Rs. 1,00,000}}{\text{Rs. 40,000}} = 2.5 \text{ years}$$

Note : Pay back period is always expressed in years.

When cashflows are not uniform.

In the previous example, it is assumed that the cash inflows are uniform. But, in practice inflows may change from year to year. In such a case, pay back period can be computed by cumulating the annual cashflows.

Example : 2 A machine costs Rs.4,00,000 and is expected to generate the following cash flows during its lifetime.

Compute the pay back period.

Year	1	2	3	4	5	6	7	8	9	10
CFAT (Rs.)	60,000	80,000	40,000	1,00,000	1,10,000	80,000	60,000	1,50,000	1,40,000	1,80,000

Solution:

Given the cashflows are not uniform we have to calculate cumulative cashflows.

Year	CFAT(Rs)	Cumulative CFAT (Rs.)
1	60,000	60,000
2	80,000	1,40,000
3	40,000	1,80,000
4	1,00,000	2,80,000
5	1,10,000	3,90,000
6	80,000	4,70,000
7	60,000	5,30,000
8	1,50,000	6,80,000
9	1,40,000	8,20,000
10	1,80,000	10,00,000

$$Pay\ back\ period = Base\ year + \frac{\text{Required CFAT}}{Next\ year\ CFAT}$$

$$Pay\ back\ period = Base\ 5 years + \frac{Rs.\ 10,000}{Rs.\ 80,000} = 5.125\ years$$ (5 years 1manth 15 day)

Example : Dugar Ltd., is producing articles by manual labour and is considering to replace it by a machine. There are two alternative models 'M' and 'N' of the machine. Prepare a statement of profitability showing the pay-back period from the following information:

	Machine M	Machine N
	Rs.	Rs.
Estimated life of the machine	4 years	5 years
Cost of the machine	9,000	18,000
Estimated savings in scrap	500	800
Estimated savings in direct wages	6,000	8,000
Additional cost of maintenance	800	1,000
Additional cost of supervision (ignore taxation)	1,200	1,800

Solution: Statement showing annual cash inlows

	Machine M	Machine N
	Rs.	Rs.
Estimated savings in scrap	500	800
Estimated savings in direct wages	6,000	8,000
Total savings (A)	6,500	8,800
Additional cost of maintenance	800	1,000
Additional cost of supervision	1,200	1,800
Total additional costs (B)	2,000	2,800
Net cashinflow (A-B)	**4,500**	**6,000**

$$\text{Pay back period} = \frac{\text{Original Investment}}{\text{Average Annual cashflows}}$$

$$Machine\ M = \frac{Rs.9,000}{Rs.\ 4,500} = 2\ years$$

$$Machine\ N = \frac{Rs.18,000}{Rs.\ 6,000} = 3\ years$$

Machine 'M' has a shorter pay-back period hence it should be preferred to Machine N.

4.3.2 Accounting or Average Rate of Return (ARR) :

This technique uses the accounting information revealed by the financial statements to measure the profitability of an investment proposal. It can be determined by dividing the average income after taxes by the average investment. According to Soloman, accounting rate of return can be calculated as the ratio, of average net income to the initial investment.

On the basis of this method, the company can select all those projects whose ARR is higher than the minimum rate established by the company. It can reject the projects with an ARR lower than the expected rate of return. This method also helps the management to rank the proposals on the basis of ARR.

$$Accounting\ Rate\ of\ \text{Return}\ (ARR) = \frac{Average\ Net\ Income}{Average\ Investment}$$

Merits: The following are the merits of ARR method:

1. It is very simple to understand and calculate;
2. It can be readily computed with the help of the available accounting data;
3. It uses the entire stream of earnings to calculate the ARR.

Demerits: This method has the following demerits:

1. It is not based on cashflows generated by a project;
2. This method does not consider the objective of wealth maximisation;
3. It ignores the length of the projects useful life;
4. It does not take into account the fact that the profits can be re-invested; and
5. It ignores the time value of money.

Example 4 : A Machine costs Rs.10,00,000 has a 5 years life and no scrap. It is depreciated on straight line basis. The expected net earnings after depreciation and taxes are as follows.

Year	1	2	3	4	5
Net Earning after Taxes (in Rs.)	1,00,000	1,50,000	2,00,000	1,80,000	1,70,000

Calculate accounting rate of return.

Solution:-

$$\text{Average earnings after taxes} = \frac{\text{Rs.}1,00,000 + \text{Rs.}1,50,000 + \text{Rs.}2,00,000 + \text{Rs.}1,80,000 + \text{Rs}1,70,000}{5}$$

$$= \frac{\text{Rs.}8,00,000}{5} = \text{Rs.}1,60,000$$

$$\text{Average Investment} = \frac{\text{Rs.}10,00,000}{2} = \text{Rs.}5,00,000$$

$$\text{Accounting Rate of Return (ARR)} = \frac{\text{Rs.}1,60,000}{\text{Rs.}5,00,000} \times 100 = 32\%$$

$$\text{ARR can also be calculated on total investment} = \frac{\text{Rs. }1,60,000}{\text{Rs. }10,00,000} \times 100 = 1$$

Example 5 :Determine the Average Rate of Return from the following data of two Machines A and B.

	Machine A (Rs)	**Machine B (Rs)**
Original cost	60,000	60,000
required Net working capital	5,000	6,000
Estimated Salvage Value	3,000	3,000
Annual Estimated Income after Depreciation and Taxes:		
Year 1	4,000	12,000
Year 2	6,000	9,000
Year 3	8,000	8,000
Year 4	9,000	6,000
Year 5	12,000	4,000
TOTAL :	39,000	39,000

Estimated life in years	5	5
Income tax rate	50%	50%

Depreciation has been charged on Straight line method.

Solution:

$$\text{ARR} = \frac{\text{Average Income}}{\text{Average Investment}} \text{ X } 100$$

$$\text{Average Income} = \frac{\text{Total Income}}{\text{No. of years}}$$

$$\text{Machine A} = \frac{\text{Rs. } 39{,}000}{5} = 7{,}800$$

$$\text{Machine B} = \frac{\text{Rs. } 39{,}000}{5} = \text{Rs. } 7{,}800$$

$$\text{Average Investment} = \frac{\text{Original Investment} - \text{Scrap Value}}{2} + (\text{working capital require}$$

$$\textit{Machine A} = \frac{Rs.60{,}000 - Rs.3{,}000}{2} + (Rs.5{,}000 + Rs.3{,}000) = Rs.36{,}500$$

$$\textit{Machine B} = \frac{Rs.60{,}000 - Rs.3{,}000}{2} + (Rs.6{,}000 + Rs.3{,}000) = Rs.37{,}500$$

$$\textit{ARR for Machine A} = \frac{Rs.7{,}800}{36{,}500} x100 = 21.37\%$$

$$\textit{ARR for Machine B} = \frac{Rs.7{,}800}{37{,}500} x100 = 20.8\%$$

Machine A is preferable, because its ARR is higher than machine B.

4.4 DISCOUNTED CASH FLOW TECHNIQUES:

The discounted cash flow methods provide a more objective basis for evaluating and selecting an investment project. These methods consider the magnitude and timing of cashflows in each period of a project's life. Discounted cashflow methods enable us to isolate the differences in the timing of cashflows of the project by discounting them to know the present value. The present value can be analysed to determine the desirability of the project. These techniques adjust the cashflows over the life of a project for the time value of money. The popular discounted cashflow techniques are:

a) Net present value

b) Internal rate of return, and

c) Profitability index

Time Value of Money.

The value of money received today is more than the value of money received after some time in the future. due to the following reasous :

i) **Inflation**: Under inflationary conditions the value of money expressed in terms of its purchasing power over goods and services declines.

ii) **Risk**: Having one rupee now is certain, where as one rupee receivable tomorrow is less certain. That is a bird-in-the-hand principle is most important in the investment decisions.

iii) **Personal consumption preference** : Many individuals have a strong preference for immediate rather than delayed consumption. The promise of a bowl of rice next week counts for little to the starving man.

iv) **Investment opportunities**: Money like any other commodity has a price. Given the choice of Rs.1000/- now or the same amount in one year time, it is always preferable to take Rs.1000/- now. because it could be invested over the next year @ 12% interest, to produce Rs.1,120/- at the end of year. If the risk-free rate of return is 12%, then you would be indifferent in receiving Rs.1000/- now or Rs.1120 in one year's time. In other words, the present value of Rs.1120/- receivable one year hence is Rs.1000/

4.5 Present value:

The value of a firm depends upon the net cash inflows generated by the firm assets and also on future returns. The amount of cash inflows and the risk associated with the uncertainty of future returns forms the basis of valuation. To get the present value, cash inflows are to be discounted at the required rate of return i.e., minimum rate expected by the investor to account for their timing and risk. The cash inflows and outflows of an investment decision are to be compared at zero time period or at the same value by discounting them at required rate of return. The following formula can be used to discount the future inflows of a project to compare with its cash outflows.

$$V_0 = \frac{C_1}{(1+K)^1} + \frac{C_2}{(1+K)^2} + \frac{C_3}{(1+K)^3} + \ldots\ldots + \frac{C_n}{(1+K)^n}$$

$$V_0 = \sum_{t=1}^{n} \frac{Ct}{(1+.k)^t}$$

Where Vo = present value of cash inflows of the project during its life time.

$C_1, C_2, \ldots C_n$ = Expected cash inflows of the project during its life time.

K = Discount rate.

n = Expected life of the project.

For example, if the annual cash inflows expected to be generated by an investment project for the next 10 years is Rs. 25,000 per annum and the rate of discount is 15%. Then the present value of the asset is :

$$V_0 = \sum_{t=1}^{10} \frac{Rs.25{,}000}{(1+.15)^{10}}$$

Using the present value of annuity table corresponding to 15% the discount rate for 10 years period the annuity factor is 5.0119.

Present value = Annual cash inflows x Annuity factor for 10 years @ 15%

So the present value is (Rs. 25,000 x 5.0119) Rs. 1,25,475/-

Example : 6

The present value of the cash flows of two machines A and B of example - 5 is calculated as :

Year	Machine A			Machine B		
	CFAT (Rs).	P.V. Factor at 10%	Present Value (Rs.)	CFAT (Rs).	P.V. Factor 0.10%	Present value (Rs).
1	4,000	0.909	3636	12,000	0.909	10908
2	6,000	0.826	4956	9,000	0.826	7434
3	8,000	0.751	6008	8,000	0.751	6008
4	9,000	0.683	6,147	6,000	0.683	4098
5	12,000	0.621	7,452	4,000	0.621	2,484
Total	**39,000**		**28,199**	**39,000**		**30,932**

Even though the total cashflow after tax (CFAT) for both machines, A and B are the same i.e. Rs. 39,000 but the present value of CFAT is different because of converting CFAT into their present value. The present value of CFAT of machine B is Rs. 30,932 which is greater than the present value of CFAT of machine A i.e.,Rs. 28,199. If the investment for both the machines, A and B is same Rs. 25,000 at zero time period investment over machine 'B' is more profitable.

4.4.1 Net present value (NPV) :

The net present value method is a classic method of evaluating the investment proposals. It is one of the methods of discounted cash flow techniques. Which recognises the importance of time value of money. It correctly postulates that cash flows arising at different time periods differ in value and are comparable only with their equivalents i.e., present values are found out.

It is a method of calculating the present value of cash flows (inflows and outflows) of an investment proposal using the cost of capital as an appropriate discounting rate. The net present value will be arrived at by subtracting the present value of cash outflows from the present value of cash inflows. According to Ezra Soloman, "it is a present value of the cost of the investment."

Steps to compute net present value :

i. An appropriate rate of interest should be selected to discount the cash flows. Generally, this will be the "cost of capital" of the company, or required rate of return.

ii. The present value of inflows and outflows of an investment proposal has to be computed by discounting them with an appropriate cost of capital.

iii. The net present value is the difference between the present value of cash inflows and the present value of cash outflows.

The formula for the net present value can be written as :

$$NPV = \left[\frac{C_1}{(1+K)^1} + \frac{C_2}{(1+K)^2} + \frac{C_3}{(1+K)^3} + \ldots\ldots + \frac{C_n}{(1+K)^n} \right] - Co$$

Thus, the net present value is the difference between the present value of the future cash inflows after tax and the present value of cash outlays. Symbolically the NPV can be expressed as :

$$NPV = \sum PVAs - \sum C_0$$

Where $\sum PVAs$ = Total present values of cash inflows.

$\sum C_0$ = Total present value of cash outlays.

The present values of capital outlays and cash inflows are to be calculated using Present Value Tables given at the end of the book. The decision criteria for accepting or rejecting a project as given here is :

NPV > Zero	Accept
NPV < Zero	Reject
NP = O	may accept or reject

In other words, if the **NPV** is positive, (i.e., the present value of cash inflows is greater than the present value of cash outflows) the project should be accepted, otherwise rejected. The accept/reject criterion under the **NPV** method can also be put as :

PV > Co	Accept
PV < Co	Reject
PV = Co	may accept or reject

Where,

PV = Total present values of cash inflows

C_0 = Total present value of cash outlays.

Zero NPV implies a situation where the firm can only recover the original investment.

Thus, under NPV technique, a project will be selected whose net present value is positive or above zero. If a project's NPV is less than "zero", it gives negative NPV, hence it must be rejected. The ranking of the proposals can be made by way of assigning ranks on the magnitude of positive net present value.

Merits: The following are the merits of the net present value (NPV) method:

(i) **Consideration to total Cash Inflows:** The NPV method considers the total cash inflows of investment opportunities over the entire life-time of the projects unlike the payback period method.

(ii) **Recognition to the Time Value of Money:** This method explicitly recognises the time value of money, which is inevitable for making meaningful financial decisions.

(iii) **Changing Discount Rate:** Since discounting rate changes due to time variations in cash inflows a changing discount rate can be used for the NPV calculations by altering the denominator.

(iv) **Best decision criteria for Mutually Exclusive Projects:** This method is particularly useful for the selection of mutually exclusive projects. It serves as the best decision criteria for mutually exclusive choice proprals.

(v) **Maximisation of the Shareholders Wealth :** finally, the NPV method is instrumental in achieving the objective of the maximisation of the shareholders' wealth. This method is logically consistent with the company's objective of maximising shareholders' wealth in terms of maximising market value of shares, and theoretically correct for the selection of investment proposals.

Demerits: The following are the demerits of the net present value method:

1. It is difficult to understand and use.
2. The NPV is calculated by using the cost of capital as a discount rate. But the concept of cost of capital itself is difficult to understand and determine.
3. It does not give solutions when the comparable projects are involved in different amounts of investment.
4. It does not give correct answer to a question when alternative projects of limited funds are available, with unequal lives.

Example 6: The Beta Co.Ltd., considering the purchase of a new machine. Two alternative machines X and Y have been suggested, each having an initial cost of Rs.40,000/- and requiring Rs.2,000/- as additional working capital at the end of 1st year. Earnings after taxes are expected as fes:

Year	Cash inflows	
	Machine X (Rs.)	Machine Y (Rs.)
1	4,000	12,000
2	12,000	16,000
3	16,000	20,000
4	24,000	12,000
5	16,000	8,000

The company has a target return on capital of 10% and on this basis you are required to compare the profitability of the machines and state which alternative you consider as financially preferable.

Note: The following table gives the present value of Re.1 due in 'n' number of years:

Year	1	2	3	4	5
P. Value 10 %	.909	.826	.751	.683	.621

Solution : Statement showing the profitability of two machines.

Year	P.V Factor	Machine X		Machine Y	
		Cash inflow (Rs.)	Present value (Rs.)	Cash inflow Rs.	Present value Rs.
1.	.909	4,000	3,636	12,000	10,909
2	.826	12,000	9,917	16,000	13,222
3	.751	16,000	12,021	20,000	15,026
4	.683	24,000	16,392	12,000	8,196
5	.620	16,000	9,934	8,000	4,967
Total present value of inflows			51,900		52,320
Total Present value of outflows (Rs. 40,000 + 2,000 x .9091)			41,818		41,818
Net Present value			**10,082**		**10,502**

Recommendation : Machine Y is preferable to Machine X. Though total cash inflow of Machine X is more than the of Machine Y by Rs.4,000/- the net present value of cash flows of Machine Y is more than that of Machine X. Moreover, in case of Machine Y, cash inflow in the earlier years is comparatively higher than that of Machine X.

IIIu. 7 : Ambani Brothers purchased a machine 5 years ago at a cost of Rs.75,000. The machine had an expected life of 15 years at the time of purchase and a zero estimated salvage value at the end of 15 years. It is being depreciated on a straight line basis and has a book value of Rs.50,000/- . The purchase manager reports that he can buy a new machine for Rs. 1,00,000/-. The existing sales are Rs. 1,00,000/ - and are expected to go up to Rs.1,10,000/- on account of purchase of the new machine. Further, it will reduce the operating cost from Rs.70,000 to Rs.50,000. The old machine's current market value is Rs.10,000. Taxes at present levied at the rate of 50% and the firm's cost of capital is 10%. Calculate the net cash outlay of the project and net cash inflows.

Solution:

(i) Net cash outlay of the new project

	Rs.	Rs.
Invoice price of new machine		1,00,000
Less: Tax savings*	20,000	
Salvage value of old machine	10,000	30,000
		70,000

(* Taxable income of the firm will be reduced by the amount of loss on sale of machinery amounting to Rs.40,000. The tax rate is 50% and hence, there will be a tax saving of Rs.20,000.

(ii) Estimated net cash in flows)

	Without new machine Rs.	With new machine Rs.
Sales....(I)	1,00,000	1,10,000
Less: Operating costs	70,000	50,000
Depreciation(D) ....(ii)	5,000	10,000
	75,000	60,000
Taxable income..(i)-(ii)	25,000	50,000
Less: Income tax	12,500	25,000
Profit after tax (P)	12,500	25,000
Cash inflow (P)+(D)	17,500	35,000

If the new machine is purchased, there will be an incremental cash inflow of Rs.17,500/-.

4.4.2 Internal Rate of Return (IRR) :

Internal rate of return (IRR) is also known as Time adjusted return or Discounted rate of return. This method is also based on the principle of present value. This method considers the relative importance of magnitude and timing of cash flows. The use of this method for appraising the investment projects was for the first time used by Joel Dean.

According to Grunewald and Nemmers, the internal rate of return (IRR) can be defined as the rate of interest that equates the present value of future period net cash flows, with the present value of the capital expenditure required to undertake a project."

Weston and Brigham defined the internal rate as the rate that equates the present value of the expected future receipts to the investment outlay."

Thus the internal rate of return can be defined as ithe rate of return which would equate the present valu'e of the investment outlay to the present value of net cash benefits."

If the IRR is greater than the cost of capital, the funds invested will earn more than their cost. When IRR of a project equals the cost of capital, the management would be indifferent to the project as it would not be expected to change the value of the firm.

The following equation is used to calculate the internal rate of return.

Formula:

$$IRR = \frac{A_1}{(1+r)^1} + \frac{A_2}{(1+r)^2} + \frac{A_3}{(1+r)^3} + ... + \frac{A_n}{(1+r)^n}$$

Where,

A_1, A_2, A_n etc. = Expected future cash inflows at the end of year 1,2,3 and so on.

Co = Initial Capital outlay.

r = rate of interest

n = number of years of project life

In order to find out the exact IRR between two near rates, the following formula is to be used.

$$IRR = L + \frac{P_1 - Co}{P_1 - P_2} \times D$$

Where

L = Lower rate of interest

P_1 = Present value at lower rate of interest

P_2 = Present value at higher rate of interest

Co = Cash outlay

D = Difference in rate of interest

Computation of IRR :

The Internal rate of return is to be determined by trial and error method. The following steps can be used for its computation.

i. Compute the present value of the cash flows from an investment ,by using an arbitrary selected interest rate.

ii. Then compare the present value so obtained with Capital outlay.

iii. If the present value is higher than the cost, then the present value of inflows is to be determined by using higher rate.

iv. This procedure is to be continued until the present value of the inflows from the investment are approximately equal to its outflow.

v. The interest rate that brings about this equality is the internal rate of return.

If the internal rate of return exceeds the required rate of return, then the project is accepted. If the project's IRR is lower that the required rate of return, it will be rejected. In case of ranking the proposals, the technique of IRR is significantly used. The projects with highest rate of return will be ranked as first compared to the lowest rate of return projects.

Thus, the IRR acceptance rules are

Accept if	r > k
Reject if	r < k
May accept or reject if	r = k

Where r is the internal rate of return

k is the cost of capital.

Merits: The following are the merits of the IRR method:

1. **Consideration of Time Value of Money** : It considers the time value of money.

2. **Consideration of total Cash Flows:** It takes into account the cash flows over the entire useful life of the asset.

3. **Maximisation of shareholders' wealth:** It is in conformity with the firm's objective of maximising owners' welfare.

4. **Provision for risk and uncertainty:** This method automatically gives more weight to money values which are nearer to the present period than those which are distant from it. Conversely, in case of other methods like 'Payback Period' and 'Accounting Rate of Return', all money units are given the same weight which is unrealistic. Thus, the IRR is more realistic method of project valuation. This method improves the quality of estimates reducing the uncertainty to minimum.

5. **Elimination of Pre-determined discount rate:** Unlike the NPV method, the IRR method eliminates the use of the required rate of return which is usually a pre-determined rate of cost of capital for discounting the cash flow streams. The IRR method itself provides a rate of return which is more realistic and consistent with the cost of capital. Therefore, the IRR is more reliable measure of the profitability of the investment proposals.

Demerits: The following are the demerits of the IRR :

1. It is very difficult to understand and use

2. It involves a very complicated computational work

3. It may not give unique answer in all situations.

4. The assumption of re-investment of cash flows may not be possible in practice.

5. In evaluating the mutually exclusive proposals, this method fails to select the most profitable project which is consistent with the objective of maximisation of shareholders wealth.

6. The results of this method may be inconsistent compared to NPV method, if the projects differ in their (a) expected lives (b) investment or (c) timing of cash inflows.

Example.8: A company has to select one of the following two projects :

	Project - A (Rs.)	Project - B (Rs.)
Capital outlay	11,000	10,000
Cash inflows (Years)		
1	6,000	1,000
2	2,000	1,000
3	1,000	2,000
4	5,000	10,000

Using the Internal Rate of Return suggest which project preferable.

Solution: The cash inflow is not uniform and hence the internal rate of return will have to be calculated by the trial and error method. In order to have an approximate idea about such rate, it will be better to find out the 'Factor'. The factor reflects the same relationship of investment and 'cash inflows' as in the case of pay back period calculations :

Therefore

$$F = I/C$$

Where,

F = Factor to be located;

I = Original Investment;

C = Average cash inflow per year

The 'Factor' in case of project - A in the above example would be :

$$F = 11,000/3,500 = 3.14$$

Where as in case of project - B the the 'Factor' would be :

$$F = 10,000/3,500 = 2.86$$

The Factor thus calculated will be located the Table value in P.V.Table-II on the line representing the year corresponding to the estimated useful life of the asset. This would give the expected rate of return to be applied for discounting the cash inflows for the internal rate of return.

In case of project-A, the rate comes to 10% while in case of project-B it comes to 15%

Project - A

Year	Cash inflows Rs.	discounting factor at 10%(Table-I)	Present value of cash inflows Rs.
1	6,000	0.909	5,454
2	2,000	0.826	1,652
3	1,000	0.751	751
4	5,000	0.683	3,415
	Total Present Value		**11,272**

The present value at 10% comes to Rs.11,272. The initial investments is Rs.11,000. Internal rate of return may be taken approximately at 10%.

But, for knowing the exactness another discount are which is slightly higher than 10% (since at this rate the present value is more than initial investment) may be taken. Let us consider a rate of 12%, the following results would emerge;

Year	Cash inflows Rs.	Discounting factor at 12%	Present value Rs.
1	6,000	0.893	5,358
2	2,000	0.797	1,594
3	1,000	0.712	712
4	5,000	0.636	3,180
Total present value			**10,844**

The internal rate of return is thus more than 10%. and less than 12% since the present values at the two discount rats are one is more than the capital outlay and another one is less than it. Hence, to get the exact discount rate at which the present values of cash inflows are equal to the capital outlay, the follwing intrapolation can be done by using the following formula.

$$IRR = L + \frac{P_1 - Co}{P_1 + P_2} x\, D$$

Where,

L = Lower rate of interest

P_1 = P.V. of cash inflows at lower rate of interest

P_2 = P.V. of cash inflows at higher rate of interest

C_o = Capital outlay

D = difference in the rates, of interests

$$\text{IRR} = 10 + \frac{11,2272 - 11,000}{11,272 - 10,844} \text{x } 2\%$$

$$= 10 + \frac{272}{428} \text{x } 2\% = 11.3\%$$

Alternativety :

The exact internal rate of return can also be calculated as follows :

At 10% the present value is + 272

At 12% the present value is - 156

The internal rate would therefore be between 10% and 12% can also be identtifid as under :

$$= 10\% + \frac{272}{(272 + 156)} \times 2$$

$$= 10 + 1.3 = 11.3\%$$

PROJECT - B

Year	Cash inflows Rs.	Discounting factor at 15%	Present value Rs.
1	1,000	0.870	870
2	1,000	0.756	756
3	2,000	0.658	1,316
4	10,000	0.572	5,720
Total present value			**8,662**

Since the present value at 15% comes only to Rs.8,662 and the fore a lower rate of discount should be taken. Let us the a rate of 10%, the following will be the result.

Year	Cash inflows Rs.	Discounting factor at 10%	Present value Rs.
1	1,000	0.909	909
2	1,000	0.826	826
3	2,000	0.751	1,502
4	10,000	0.683	6,830
Total present value			**10,067**

The present value at 10% comes to Rs.10,067 which is more than the initial investment. Hence, the internal rate of return may be taken as 10%. approximately.
In order to have more exactness, the internal rate of return can be intarpolated as done in case of project - A.

At 10% the present value is + 67

At 15% the present value is - 1,338

Alternatively

$$IRR = 10\% + \frac{67}{67 + 1{,}338} \times 5$$

$$IRR = 10\% + \frac{67}{1{,}405} \times 5 = 10\% + 0.24 = 10.24\%$$

$$IRR = 10 + \frac{10067 - 10{,}000}{10067 - 8662} \times 5$$

$$IRR = 10 + \frac{67}{1405} + 5$$

$$= 10.24\%$$

Thus, the internal rate of return in case of project-A is higher as compared to project-B. Hence , project-A is preferable. Which produces more amount of beenfit.

Example. 9 : A firm whose cost of capital is 10% is considering two mutually exclusive projects X and Y, the details are :

	Project X Rs.	Project Y Rs.
Investment	70,000	70,000
Cash flow year 1	10,000	50,000
Cash flow year 2	20,000	40,000
Cash flow year 3	30,000	20,000
Cash flow year 4	45,000	10,000
Cash flow year 5	60,000	10,000
Total cash flows	1,65,000	1,30,000

Compute the Net present value at 10% and Internal rate of return for these two projects.

Solution:

(i) Net present value of the two mutually exclusive projects, cost of capital of the firm being 10 percent.

Year	Cash Flows (Rs.)		P.V.Factors	Discounted Cash Flows (Rs.)	
	Project X	Project Y	at 10%	Project X	Project Y
0	(-) 70,000	(-) 70,000	1.000	(-) 70,000	(-) 70,000
1	10,000	50,000	.909	9,090	45,450
2	20,000	40,000	.826	16,529	33,040
3	30,000	20,000	.751	22,530	15,020
4	45,000	10,000	.683	30,735	6,830
5	60,000	10,000	.621	37,260	6,210
	Net Present Value (Rs.)			**46,135**	**36,550**

(ii) Internal Rate of Return for the two projects:

Project X :

Year	Cash flows (Rs.)	P.V.Factor at 25%	Discounted Cash Flows (Rs.)	P.V. Factor at 30%	Discounted Cash Flows (Rs.)
0	(-) 70,000	1.000	(-) 70,000	1,000	(-) 70,000
1	10,000	.800	8,000	.769	7,690
2	20,000	.640	12,800	.592	11,840
3	30,000	.512	15,360	.455	13,650
4	45,000	.410	18,450	.350	15,750
5	60,000	.328	19,680	.269	16,140
Net Present Value (Rs.)			4,290		(-) 4,930

$$IRR = 25\% + \frac{4,290}{9,220} X\ 5$$

$$= 25 + 2.33 = 27.33\%$$

Project Y :

Year	Cash flows (cfat) (Rs.)	P.V.Factor at 35%	Discounted Cash Flows (Rs.)	P.V.Factor at 40%	Discounted Cash Flows (Rs.)
0	(-) 70,000	1.000	(-) 70,000	1,000	(-) 70,000
1	50,000	.741	37,050	.714	35,700
2	40,000	.549	21,960	.510	20,400
3	20,000	.406	8,120	.364	7,280
4	10,000	.301	3,010	.260	2,600
5	10,000	.223	2,230	.186	1,860
Total Present Value			2,370		(-) 2,160

$$IRR = 35 + \frac{2,370}{4,530}\ X\ 5 = 37.61\%$$

Hence, the IRR of project Y is greater (37.61) than the project X (27.33)

4.4.3 Profitability Index (PI) :

This method is also known as 'Benefit Cost Ratio'. According to Van Horne, the profitability Index of a project is "the ratio of the present value of future net cash flows to the present value of initial cash outflows".

$$\text{Profitability Index} = \frac{\text{Present value of cash inflows}}{\text{Present value of cash outflows}}$$

On the basis of this criteria, the projects can be accepted when the profitability index is equal to or greater than '1' (one).

Merits : The merits of this method are :

i. It takes into account the time value of money

ii. It helps to accept / reject investment proposals on the basis of value of the index.

iii. It is useful to rank the proposals on the basis of the highest / lowest value of the index.

iv. It takes into consideration the entire stream of cash flows generated during the life of the asset.

However, this technique suffers from the following limitations :

i). It is some what difficult to understand

ii). It is difficult to understand the analytical part of the decision on the basis of profitability index.

Example.10

Consider the information given in example 9.

Project : X

The present value of total cash inflow is Rs.1,16,135 and the present value of outflow is Rs.70,000

$$Profitability\ Index\ (PI) = \frac{Rs.\ 1{,}06{,}550}{Rs.70{,}000} = 1.659$$

Project : Y

The present value of total cash inflow is Rs.1,06,550 and the present value of out flow is Rs. 70,000

$$Profitability\ Index\ (PI) = \frac{Rs.\ 1{,}06{,}550}{Rs.70{,}000} = 1.522.$$

Since the profitability Index of project X (1.659) is greater than profitability index of project Y (1.522), it is advisable to accept the project X.

Example 11. Calculate the profitability index from the information given below. Cost of project Rs.60,000 ; life of the project 5 years. Annual cash inflow Rs.20,000; cost of capital 10%

Solution:

Calculation of profitability index :

Year	CFAT	P.V.Factor 10%	Total present Value
1-5	Rs. 20,000	3.791	Rs. 75,820

$$Profitability\ Index\ (PI) = \frac{Rs.75{,}820}{Rs\,60{,}0000} = 1.263.$$

4.5 NET PRESENT VALUE VS. PROFITABILITY INDEX :

In most of the situations the NPV and PI as investment criteria, provide the same accept or reject decision. and both the methods are closely related to each other. Under PI method, the investment proposal will be accepted, if the PI is greater than one, PI will be greater than one when the investment

proposal has a positive NPV. On the other hand, PI will be less than one when the investment proposal has negative NPV. In case of mutually exclusive investment proposals these methods may give different rankings. The following example present such a case.

Year	Project A Rs.	Project B Rs.
O (outflows)	-5,000	-3,500
1 (inflows)	4,000	3,000
2 (inflows)	4,000	3,000
Present value of cash inflows @ 10%	6,944	5,208
Less cash outflows	5,000	3,500
NPV	1,944	1,708

$$\text{Profitability Indedx} = \frac{6,944}{5,000} = 1.39 \quad \frac{5,208}{3,500} = 1.49$$

Thus, project A is acceptable under NPV method, while project B is acceptable under PI method. Which project should the company accept? As explained earlier, the NPV technique is superior so, project A should be accepted. The best project is one which adds the most, among the available alternatives, to the shareholders wealth. So, one can say that NPV method gives a better mutually exclusive choice than PI and guarantees the choice of the best alternatives.

4.6 NET PRESENT VALUE VS. INTERNAL RATE OF RETURN (IRR)

The NPV and IRR methods are similar in several respects. In certain cases they would give the same accept or reject decision but they give different decision in certain other cases. The comparison of these methods involves the discussion of between the methods :

i) Similarities

ii) Differences

Similarities :

The two methods would give consistent results in terms of acceptance or rejection of investment proposals in certain situations. If a project is sound it will be indicated by both the methods. If the project does not qualify for acceptance, both methods will indicate that it should be rejected.

Conventional and Independent projects :

In case of conventional and independent projects both NPV and IRR methods will give the same accept-reject decision. A conventional project is one in which the cash flow pattern is such that an initial Capital outlay is followed by cash inflow. capital outflows are confined to the initial period that is, in the beginning.

The independent projects refer to the investment proposals the acceptance of which does not make rejection of another profitable project. All profitable proposals can be accepted, if funds are available. There are no other constraints in accepting all profitable projects. Same projects would be indicated profitable by both NPV and IRR methods. The logic is all projects with positive NPV would be accepted, if NPV method is used or projects with IRR higher than the required rate of return would be accepted, if the IRR method is followed. The last project acceptable under NPV is one which has zero net present value, while using the IRR method this project will have an IRR equal to required rate of return. Projects with positive net present values would also have internal rate of return higher than the required rate of return. Marginal or last project will have zero net present value only, when its internal rate of return is equal to the required rate of return. NPV and IRR methods are equivalent as regards the acceptance or rejection of conventional and independent projects.

Decision Rule :

Accept a project if NPV is greater than zero (NPV >0)

if IRR is greater than required rate of return (IRR > k)

May accept/ if NPV is equal to zero (NPV = 0)

reject a project if IRR is equal to required rate of return (IRR = K)

reject a project if NPV is Negative or less than zero (NPV <0)

if IRR is less than required rate of return (IRR < K)

Projects which have positive NPV will also have an IRR higher than the required rate of return

Projects which have negative NPV will also have an IRR lower than the required rate of return.

Projects which have zero NPV will also have an IRR equal to the required rate of return.

Differences :

In case of independent and conventional Projects, NPV and IRR methods will give the same result. However, in certain situations they will give contradictory answers. If NPV method finds one proposal acceptable, IRR favours another. This happens in case of mutually exclusive projects.

Mutually Exclusive projects:

Mutually exclusive projects are those projects where the acceptance of one proposal makes the rejection of another one. If there are alternative courses of action, only one can be accepted, such alternatives are mutually exclusive. The mutual exclusiveness may be of two types. i) Technical, and ii) Financial.

For example, in order to distribute its products, a company may decide either to establish its own sales organisation or engage outside distributor. The more profitable, out of the two alternatives shall be selected. Ranking projects become crucial in case of mutually exclusive projects. Since, the NPV and IRR rules can give conflicting ranking of projects. In case of ranking given by NPV and IRR methods is different for mutually exclusive projects, it is advisable to use NPV method which is consistent with the objective of maximising wealth of the shareholders.

ii) Non - Conventional Investments:

Non-conventional investments are the investments, whose cash outlay may not yield a series of cash inflows. Further, investment may be required to make use of the project. The project may require additional investment during its life time. A classic example of non-conventional investment pattern is that the purchase of an asset generates cash inflows for a period of years, is overhauled, and again generates a stream of cash inflows for a number of years. A machine may be purchased for Rs.1,00,000/- and generates cash inflows of Rs.25,000/- each for seven year. In the eighth year an outlay (investment) of Rs.40,000/- is required to overhaul the machine, after which, it generates cash inflows of Rs.25,000 each for 7 years.

In this case, the NPV and IRR methods will give conflicting ranking to the projects. Because, IRR methods, yields more than one rate of return. The number of rates of return depend on the number of times the sign of cash flow stream changes. In order to solve this problem, it is advisable to use NPV method in selecting non-conventional investment projects.

NPV and IRR choice of the Methods:

In the case of conventional and independent projects as the both methods, NPV and IRR, give the same results. However, in case of mutually exclusive projects and projects with non-conventional investments NPV and IRR methods give contradictory results. Then it is advisable to use NPV method because of its superiority over IRR. Moreover, the NPV method is consistent with the objective of maximising the wealth of the shareholders.

4.7 CAPITAL RATIONING :

Capital rationing refers to the situation where budgetary or fund constraints are imposed on the firm and the firm may not be in a position to invest its available scarce resources in all the acceptable projects. According to Weston and Brigham, "capital rationing is a situation where a constraint is placed on the total size of funds invested" during a particular periods. "Under the situation of capital rationing, it is not possible on the part of the company to select all the available investment proposals due to financial constraints". Hence, the company has to rank the proposals applying the techniques of appraisals and finally select the best proposals within the available funds.

Causes for Capital Rationing

The reasons for imposing restrictions on the finances of the company and evidence of capital rationing are as follows:

i. It is difficult to raise funds through external sources;

ii. Some firms may impose limitations on capital expenditure due to lack of managerial re sources;

iii. A firm may resort to capital rationing due to the reason that its cost of capital may rise by way of raising additional fundsand ;

iv. Some may not be interested in further expansion, but they may be interested to stabilise the present position.

Project Selection under Capital Rationing:

Selection of projects under capital rationing is made by :

a. ranking the projects according to Internal Rate of Return or Profitability Index.
b. selecting the projects in descending order of the ranks until the budgeted funds are exhausted.
c. not selecting the investment project with negative Net Present Value (NPV) or Internal Rate of Return (IRR) or below the cost of capital.

4.8 SUMMARY :

Capital budgeting involves the firms decisions to invest its current funds most efficiently in long-term projects, in anticipation of expected flow of future benefits over a series of year.

The capital budgeting decisions include replacement, expansion, diversification, research and development and miscellaneous proposals. Capital budgeting decisions are important because they involve investment of heavy funds, with long - term implications. These decisions are most difficult to take.

The capital budgeting process involves generation of investment proposals, estimation and evaluation of cash flows, selection of projects based on acceptance criterion and finally continuous evaluation of investments

A sound appraisal method should enable the company to measure the real worth of the investment proposal. There are two traditional methods and three discounted cash flow methods for this purpose. They are the pay back method and the accounting rate of return in the first group and the net present value, internal rate of return and profitability index methods in the second group.

Capital rationing is a situation where a constraint is placed on the total size of funds invested during a particular period. Some reasons for capital rationing include self imposed and some are external reasons.

4.9 Key words :

Accounting Rate of Return Also called Average Rate of Return. It is calculated by dividing the average income after taxes by the initial outlay of a project. A variant of this is presented by the average income after taxes by the average investment.

Benefit Cost Ratio Also called as Profitability Index. Used to evaluate capital expenditure proposals, it is calculated by dividing the present value of cash inflows by the initial outlay.

Cash Flows Actual receipts and payments by a firm.

Discounting The process of finding out the present value of a series of future cash flows.

Investment Decision Refers to capital budgeting decision i.e. investment in long - term assets.

Payback period The number of years required to recover the investment required by a project.

Present value The value of sums received in future being discounted by an appropriate capitalisation rate.

Net present value Net present value represents the difference between the present value of future cash flows associated with a project and the present value of the initial investment to acquire the project.

Internal Rate of Return. The Rate of Return that equates the present value of future cash flows to the initial investment on the project.

4.10 SELF ASSESSMENT QUESTIONS EXERCESIS

Short Questions

1). What is pay bach period ? Discurs its merits and demerits.

2). Why are traditional methods of capital budgeting still popular ?

3). What is time value of money? Explain its impartance in the Financil Decesions.

4). What is Net Present Value Method? How do you calulate with an example ?

Essay questions

5. What do you mean by Discounted Cash Flow techniques? Explain NPV and Profitability Index methods to fulfill the requirements of time value of money.

6. Define Internal Rate of Return, How are project selection taken under this method?

7. Define capital rationing and explain the causes How are the project selection made under capital rationing ?

8. Following are the details of ree project A,B and C.

Project	A	B	C
Cost (Rs.)	50,000	70,000	70,000
Life	10 Years	12 Years	14 Years
Estimated Scrap (Rs.)	5,000	10,000	7,000
Annual Profit Less Taxation (Rs.)	5,000	6,000	5,500

Calculate the pay back period.

(Ans: Project A 5.26 Years; Project B: 6.36 years, Project C: 7 years)

9. The Directors of Gama Ltd., are considering the purchase of a new Machine. Two Machines costing Rs.60,000 each are available. Each machine has an expected life of 5 years. The cosporate tax rate is 50%Net profit before tax during the expected life of each machine are given as follows :

Year	Machine X Rs.	Machine Y Rs.
1	15,000	5,000
2	20,000	15,000
3	25,000	20,000
4	15,000	30,000
5	10,000	20,000
	85,000	90,000

Following the method of Return on Investment ascertain which of the alternatives will be more profitable.

(Ans : Average Profit (after tax) : Machine X Rs.8,500; Machine Y Rs.9,000; Average Investment : Machine X Rs.30,000; Machine Y Rs.30,000; Average Rate of Return : Machine X : 28.33%; Machine Y 30% ; Thus, Machine Y is more profitable as against Machine X)

10. Mehta Co. Ltd., is considered the purchase of a new machine. Two Machines A and B are available each costing Rs.1.00.000. Earnings after taxation are as under :

Year	Machine X (Rs.)	Machine Y (Rs.)
1	30,000	10,000
2	40,000	30,000
3	50,000	40,000
4	30,000	60,000
5	20,000	40,000
	1,70,000	1,80,000

Calculate the ARR for each machine.

(Ans : Average Cash Inflows : Machine A Rs.34,000; B Rs.36,000; Average Investment : Machine A Rs.50,000; Machine B Rs.50,000; Annual Depreciation : Machine A Rs.20,000; Machine B Rs.20,000 ; ARR for Machine A 28%; ARR for Machine B 32%)

11. Sundaram Ltd. is planning to increase its present capacity and is considering the purchase of a new machine. Machine M and N are available at a price of Rs.80,000 and Rs.90,000 respectively. The company can buy either of the two machines. Cash flows on there machines are estimated as follows:

	Cash Inflows (Rs)	
Year	Machine M	Machine N
1	25,000	26,000
2	30,000	34,000
3	40,000	28,000
4	28,000	40,000
5	12,000	25,000
6		17,000

There is no salvage value. of both the Machines as the end of their lives .

Which of the two machines should the company buy? Decide on the basis of (i) payback period, and (ii) average rate of return.

(Ans: (i) Payback period : Machine M:2.63 years, Machines N:3.05 years; (ii)ARR : Machine M 27.5%, Machine N 29.6% Machine A is preferable)

12). Praga Tools Ltd., is considering an investment proposal. The cost of the project is Rs.50,000/- and has a life of 5 years with no salvage value, the company's tax rate is 55% and the firm uses straight line method of depreciation. The requird rate return of the proposal is 10%.The estimated cash flows before tax (CFBT) from the proposed investment are :

Year	CFBT(Rs.)
1	10,000
2	11,000
3	14,000
4	15,000
5	25,000

Calculate Pay back period, ARR , IRR, NPV, and PI

(Ans) PBP 4.328 years ; ARR 9% ; IRR 6.59 ; NPV - Rs.4,648 ; and PI 0.907

13) DCM Ltd., considering mutually exclusive project A and B each involving a cost of Rs.3,00,000/-.The expected life of the project is 5 years for which the cash flows after tax (CFAT) are given below.

Year	Project A	Project B
1	1,00,000	50,000
2	1,00,000	50,000
3	1,00,000	1,00,000
4	1,00,000	2,00,000
5	1,00,000	1,00,000

The required rate of return is 15%. Decide which project should be selected by computing a) Pay back period b) Accounting rate of return c) Net present value d) Internal rate of return and e) Profitability index.

(Ans :

14) A machine was purchased 4 years ago for Rs. 70,000/- has been depreciated to a book value of Rs. 50,000/-. The machine originally had a project life of 14 years and a zero salvage value. A new machine will cost Rs. 1,30,000/-. Its installation cost estimated by the technician is Rs. 20,000/-. The technician also estimates that the installation of a new machine will result in a reduced operating cost of Rs. 15,000/- per year for the next 10 years. The old machine could be sold for Rs. 80,000/-. The new machine will have a ten year life with no salvage value. The company's normal income is taxed at 55% and gains at 30%. Assuming the cost of capital is 10%, determine whether the existing machine should be replaced. Use discounted cash flow criteria, i.e. NPV and IRR.

(Ans) NPV Rs. 8,723.75, IRR 7.53%.

8) A company is considering the purchase of a delivery van and is evaluating the following two choices.

1) The company can a used van for Rs. 20,000/- after 4 years sell the same for Rs. 2,500/- (net of taxes) and replace it with another used van which is expected to cost Rs. 30,000/- and lost 6 years with no terminating value.

2) The company can buy a new van for Rs. 40,000/-. The projected life of the van is 10 years and has an expected salvage value (net of taxes) of Rs. 5,000/- at the end of tenth year.

The services provided by both the vans are same. Assuming the cost of capital 10%, which choice is preferable ?

(Ans) : Present value of outflows of choice 1 is Rs. 38,782, whereas the present value of outflows of choice 2 is Rs. 38,070. Hence choice 2 is preferable.

16) A company working against a self-imposed capital budgeting constraint of Rs. 3,50,000/- is trying to decide which of the following investment proposals should be undertaken by it? All the investments are mutually independent (do not affect one another's cash flows). The list of investments along with the investment required and the net present value of the projected cash flows are as follows :

Investments	Outlays (Rs.)	NPV (Rs.)
A	50,000	30,000
B	1,20,000	90,000
C	1,60,000	1,00,000
D	1,10,000	1,50,000
E	90,000	1,00,000

Which investments should be acquired by the company ?

(Ans) D,E and B.

10) A textile company currently expects its after-tax profits (EAT) for the next 5 years to be as follows :

Year	1	2	3	4	5
EAT (Rs.)	34,000	28,000	60,000	44,000	50,000

The firm is considering to replace the existing machine with one costing Rs. 27,000/-. The new machine would cost Rs. 3,000/- to install and would be depreciated over 5 years to zero salvage value. The existing machine was purchased for Rs. 12,000/- three years ago and is being depreciated by the straight line method over an 8-years period. It can be sold for Rs. 15,000/- currently with Rs. 1,000/- removal cost.

If the expected after-tax profits, after the acquisition of new machine are as given below, at what approximate rate of cost of capital would the firm be indifferent regarding the purchase of new machine? The firm is taxed at a rate of 55% on normal income and 30% on capital gains.

Year	1	2	3	4	5
EAT (Rs.)	40,000	28,000	65,000	50,000	55,000

7)

Also suggest at which rates of cost of capital the firm would (i) accept and, (ii) reject the proposed investment ? What is the economic logic for your answer?
(Ans) i) Less than 36% ii) More than 36%

4.11 FURTHER READINGS

Pandey I.M.	:	Financial Management, Vikas Publishers, New Delhi
Khan & Jain	:	Financial Management Tata Mc Graw Hill publishing Co., NewDelhi.
Maheswari S.N.	:	Financial Management, Sultan Chand & sons, New Delhi.
James, C. Van Horne	:	Financial Management and Policy New Delhi, Prentice-Hall of India., New Delhi.
Solomon. Ezra	:	Theory of Financial Management : New York, Columbia University press.
Weston J.F. and Brigham E.F.	:	Managerial Finance, Holt, Rinehart and Winston