UNIT 10 TIME VALUE OF MONEY

Structure

10.1 INTRODUCTION

Most business ventures involve utilisation of other people's money. The proper sourcing of funds and the optimum utilisation of the funds, so raised play important role in the successful conduct of financial management. The main problem in financial management is that the funds are raised at different points of time and are employed into the business at different points of time. Matching the timings of rise of funds and the employment of funds and optimizing the time related costs are very crucial for the success of a finance manager. In this context 'time value of money' becomes important.

Objectives

After studying this unit, you should be able to

- indicate the relevance of time value concept,
- know about capital and money markets,
- analyse reasons for having interest,
- use the interest rate formulae and acquaint yourself with the applicability aspects of time value concepts, and
- work out problems involving time value of money concepts and use the time value tables.

10.2 RELEVANCE OF THE CONCEPT

The time value concept of money assumes importance because of the fact that future is always associated with uncertainty. A rupee in hand today is valued higher than the one rupee that is expecting to be recovered tomorrow. The following are points that come in support of the fact that the concept of time value of money is quite relevant in any area of decision making :

(a) The purchasing power of money over period of time goes down in real times. That means, though numerically the same, the purchasing power of one rupee today is considered to be high economically than its value as on a future date.

(b) Individuals prefer present consumption to future consumption. This is because of the risk and uncertainty associated with future.

(c) There is always related costs in any investment. These costs tend to bring down future value of money.

(d) In financial management, most of the problems involve cost-flows occurring at different points of time. For evaluation and comparison on an uniform basis, the concept of time value of money is used.

(e) The concept is also important for purpose of valuation of shares and firms.

10.3 FINANCIAL MARKETS

For understanding the concept of time value of money, an insight into the financial markets is quite important. A financial market is a place where money is traded. Just take any other market, there are buyers and sellers in the segment of market too. The buyers of money or funds are people/entrepreneurs/industrialists who have viable projects with them and who are looking out for sources of finance. The sellers of the money are people who have surplus money/funds and who are ready to lend the same on agreed terms. The agreed terms mostly centre around the interest and principal repayment schedule. Since the borrowings and repayments take place at different points of time the interest factor plays a very important role.

The financial markets can be broadly classified into two categories, i.e. the capital/ investment markets and money markets. Though a clear distinction between the two is not always clear because of overlappings it is the length of time which distinguishes the two. Markets when funds are borrowed/loaned for a year or less are referred to as money markets. Capital markets encompass longer term obligations.

Capital Markets

Capital markets deal in the following types of securities :

* Corporate securities
* Government of India bonds
* State and local bonds
* Corporate equities
* Mortgages
* Mutual fund units

Money Markets

Money markets which are described as centres of short term funds include the following major segments :

* Treasury bills
* Commercial bank loans
* Commercial papers
* Bankers acceptances
* Certificates of deposits

10.4 INTEREST FACTOR

Interest is one of the most important in the portion of financial management. Interest has become relevant because of time value of money. Interest is supposed to be the bridging concept in time value of money. Interest is defined as the rental charged for the use of borrowed money. Without applying the concept of interest, decision making for financial management will be irrelevant.

10.4.1 Reasons for Having Interest

The two primary reasons for having interest are as follows :

- the opportunity to invest money, and
- the desire to spend it.

Money has an opportunity cost. When we are investing money for a future period we always sacrifice the present consumption. Further, we always anticipate that the value of any investment after a planned holding period to be higher than the original investment. Unless the concept of interest is applied, it may not be possible to realise the objective.

10.4.2 Parties Point of View

In any financial market there are two parties, viz. borrowers and lenders. From borrowers points of view, interest is justified as there is opportunity to invest borrowed money at higher rate than the rate paid for its use. From lender's point of view, interest represents his compensation for not being able to spend his money elsewhere.

10.4.3 Interest Rate

Regardless of the type of loans involved, interest rate is a function of the supply and its demand for money. Short term interest rates are determined by current supply and demand factors. Long term interest rates are determined by the anticipated supply and demand relationships over the life of the interest bearing security. When funds are in short supply relative to demand, short term interest rate can be expected to rise. When short term rates go up, long term rate cannot help the affected.

Level of interest rates has a significant impact on the nations economy. The changes on interest rates cause money shift from one financial market to another. The most important factor from business viewpoint is the ease with which long term capital projects can be financed.

10.4.4 Interest Calculations

The amount of interest associated with any type of financial transaction can be calculated by using six standard formulae. They are discussed in the ensuing paragraphs.

(i) Single Payment (Compound) among Factor

This is the basic formula in the concept of time value of money. This is the future amount of 'S' that some present amount 'P' will accumulate in 'n' years at i percent interest rate. The formula is as follows :

$$S = P(1+i)^n$$

The same is illustrated by means of some examples.

Example 1

A present value of Rs. 1000 at an annual interest rate of 10% over a period of 10 years will accumulate as

$$S = 1000\,(1 + 10)^{10} = \text{Rs. } 2593.70$$

Thus, a present value of Rs. 1000 at an annual interest rate of 10% over a period of 10 years will have a compounded value of Rs. 2593.70.

Example 2

A sum of Rs. 5000 at an annual interest rate of 20% over a period of 8 years will have a compounded value of Rs. 21499.

(ii) Single Payment Present Value Factor

This factor is the amount 'P' that a future amount S recoverable in 'n' years is now worth with interest at 'i' percent. This is the reciprocal of case (i). The formula is

$$P = S\left(\frac{1}{(1+i)^n}\right)$$

Example 1

The present value of 5000 recoverable at the end of the 5th year, at an annual interest rate of 10% will be Rs. 3104.61.

Example 2

The present value of Rs. 1000 recoverable at the end of the 8th year at an annual interest rate of 20% will be Rs. 232.60.

(iii) Annually Compound Amount Factor

This is the amount S that an equal payment R will accumulate to on 'n' years at 'i' percent interest. The formula is

$$S = R\left(\frac{(1+i)^n - 1}{i}\right)$$

Example 1

An equal annual payment made at the end of each year of Rs. 1000 at an annual interest rate of 20% will accumulate at the end of the 10th year to Rs. 25958.

Example 2

An equal annual payment made at the end of each year of Rs. 5000 at an annual interest rate of 10% will accumulate at the end of the 20th year to Rs. 286375.

(iv) Sinking Fund Factor

This factor is the equal amount 'R' that must be invested at 'i' percent in order to accumulate to some specified future amount 's' over a period of 'n' years. This is the reciprocal of case (iii). The formula is

$$R = S\left(\frac{i}{(1+i)^n - 1}\right)$$

Example 1

To obtain an accumulated amount of Rs. 100000 over a period of 10 years at annual interest rate of 10% an equal amount of Rs. 6274.71 should be invested at the end of each year.

Example 2

To obtain an accumulated amount of Rs. 500000 over a period of 5 years at an annual interest rate of 18%, an equal amount of Rs. 90018 should be invested at the end of each year.

(v) Capital Recovery Factor

This is the annual payment 'R' required to amortize or completely pay off, some present amount 'P' over 'n' year at 'i' per cent interest. The capital recovery factors is equal to the sinking fund further plus the interest rate. The formula is

$$R = P\left(\frac{i(1+i)^n}{(1+i)^n - 1}\right)$$

Example 1

The annual amount required to pay off a present amount of Rs. 500000 over 5 years at 20% interest rate is Rs. 1,67,189.75.

Example 2

An annual amount of Rs. 230225.72 is required to pay off a present amount of Rs. 100000 over 8 years at 16 percent interest rate.

(vi) Annually Present Value Factor

This is the present amount 'P' that can be paid off by equal annual payments of R over 'n' years with 'i' percent interest or the present value P of an 'n' year annually 'R' discounted at 'i' percent. This is the reciprocal of case (v). The formula is

$$P = R\left(\frac{(1+i)^n - 1}{i(1+i)^n}\right)$$

Example 1

The present value of an equal annual payment of Rs. 10000 made at the end of each year for a period of 5 years discounted at a rate of 10% will be Rs. 3789.60.

Example 2

If we intend discharging a debt by making an annual payment of Rs. 20000 made at the end of each year over a period of 3 years which are subjected to an annual discount rate of 20%, the same can be made through one time lump sum payment of Rs. 42130 that can be made today.

10.4.5 Frequency of Compounding

In time value of money, in addition to base interest rate, the frequency with which interest is compounded also has an important bearing on the total interest charges associated with an instrument. The frequency of compounding is denoted by the standard formula of $(1 + i)^n$. For example, a carrying charge of 1.0 percent per month compounded monthly will be equal to an annual interest rate of $(1.01)^{12}$, i.e. 12.7 percent. Similarly, a 1.5 percent monthly rate is equivalent to 19.7% once annually. The more the frequent interest is compounded within the same year, the annual rate will be higher and higher. Compounding on a daily basis will have the highest annualised compound rate of interest for the same simple interest rate.

You may notice that the expression $(1 + i)$ appears in all six of the basic interest formulae. If the total elapsed time is held constant (normally 1 year) and the compounding period is reduced (or in the other way the frequency of compounding is increased, the value of this expression will also increase. The compounding frequency may be the deciding factor in choosing an investment from alternatives all of which has the same return. For example, in case of all investments having 6.0 percent annually, the effective rates may vary depending upon compounding frequency. The effective interest rate on money compounded annually is 6.00 percent. Semi-annually 6.09 percent, quarterly 6.14 percent, bimonthly 6.15 percent, monthly 6.18 percent and continuously 6.19 percent.

10.4.6 Average Interest Estimation

A loan is usually paid back in a series of equal payments. Hence, the outstanding balance may be construed as half of the initial amount of the loans and the average interest paid is construed to be half the prescribed normal interest rate.

For example, Rs. 1000 were borrowed for a year at 6% and paid back in monthly instalments, the average outstanding balance may be about Rs. 500 (meaning that the borrower over a year's time initially had the use of only Rs. 500 on the average) and the average interest paid would be about 3% of the initial amount or Rs. 30 in total. But if Rs. 60 were charged as interest on this same loan – present initial amount – the true interest rate would be nearly 12 percent as Rs. 60 is paid on average loan of only Rs. 500.

Thus,

$$\text{Average Interest} = \frac{i}{2}\left(\frac{(n+1)}{n}\right)$$

where 'i' is the interest rate and 'n', the number of years.

This formula is actually only a rough approximation of the capital recovery factor less the straight line depreciation rate. Taking an example, the average interest on a 6% rate for 10 years loan is approximated at 3.30 percent by using the average interest formula while the capital recovery factor (0.1359) less the straight line depreciation rate (0.100) sets the actual average interest rate. That is why, the use of average interest formula in the area of engineering economics is very rare.

SAQ 1

(a) What is the present value of Rs. 5000 receivable after 3 years at an interest rate of 10% worth today ?

(b) Mr. Ashish plans to send his son for higher studies abroad after 10 years. He expects the cost of those studies to be Rs. 500000. How much should he save to have such of Rs. 500000 at the end of 10 years if the interest rate is 12 percent ?

(c) A finance company advertises that it will pay a lump sum of Rs. 50000 at the end of 6 years to investors who deposit annually Rs. 5000. What interest rate is implicit in the offer ?

(d) What is the value of Rs. 8000 at an interest rate of 18% per annum if (i) compounded yearly, (ii) compounded quarterly, and (iii) compounded monthly.

10.5 INTEREST AND DISCOUNT FORMULAE

Interest rates and discount rates are the important tools used in the concept of time value of money. They are normally the two sides of the same coin. The future value of a present sum is the "compounded figure" at a particular rate of interest whereas the present value of a future sum is the discounted figure at a particular rate of discount. The usefulness of the discount and interest factors are widely felt in the parlours of financial management as any decision making will be irrelevant and untenable in the absence of the concept of time value of money.

The single payment compound amount factor is used in measuring the growth rates. For example, the population figures of a country at two points of time can be attributed to a particular annual rate of growth, the concept useful in economic indication. The four annuity type interest formula can be used whenever a uniform stream of receipts and payments are involved. The capital recovery factor is very useful in engineering economy studies in which alternatives having different useful service lives are being compared.

10.6 INTEREST TABLES

A good set of interest tables, giving numerical values for all six types of basic interest formulae for different interest rates and time periods, form part of every engineering economists library. Most standard finance/engineering economics text books include such tables. But the usefulness of such tables may be restricted because of the limited range of values presented. In capital budgeting, and project analysis etc., interest rates upto 25% and sometimes higher are often used.

The table given in Appendix I (some rows are shown below) shows the various calculations on the basis of interest formulae discussed earlier for an interest rate of 10%. Similarly, the table will contain the figures for interest rate normally upto 25%.

5 Years	1.6105100	0.6209213	0.1637975	0.2637975	6.1051000	3.7907868
6 Years	1.7715610	0.5644739	0.1296074	0.2296074	7.7156100	4.3552607
7 Years	1.9487171	0.5131581	0.1054055	0.2054055	9.4871710	4.8684188

The first column of the table shows the compound amount factor. It shows that the amount that a rupee accumulates to over N time periods. One rupee invested on at the interest rate of 10% accumulates to Rs. 2.59 over 10 years period and to Rs. 6.75 in 20 years. In the second column, the present worth factors are mentioned. They are the reciprocals of the compound amount factor. For example, Re. 1 receivable in 10 years is worth only Rs. 0.386. Now, Rs. 2.59 receivable in 10 years has a present worth of .2.59 × 0.386 (Re. 1). The sinking fund factor in the third columns shows the amount that must be invested at 10% each year to accumulate Re. 1 in '*n*' years. For example, Rs. 62.75 must be invested annually to accumulate with interest to Rs. 1000 in 10 years.

The fourth column which relates to capital recovery factor, shows the annual payment required to cover principal amount and interest in equal annual amounts over an '*n*' years period.

A Rs. 1000 loan can be returned in 5 years by paying back Rs. 243.80 annually. A total of Rs. 1319 will be paid of which Rs. 1000 is principal and Rs. 319 is the interest.

The compound factor in the fifth column shows that the total accumulation, with interest, of an equal amount invested each period for '*n*' periods. If Rs. 1000 were invested each year at 10 percent for 20 years, the total amount that would accumulate at the end of the 20th year would be 1000 × 57.275 or Rs. 57275. In this case, Rs. 20000 represents the principal, the remaining Rs. 37275 being interest.

The last column indicates the present worth of an uniform annual source of payments. This shows that to purchase a Rs. 1000, 20 years, 10 percent annually requires a present payment of Rs. 8514. In a project returning Rs. 1000 annually for 20 years has a present value of Rs. 8514.

In interest table, time periods usually are years, but they can be taken as quarters, months or any other units of time. A 1.0 percent rate compounded monthly is roughly equivalent to a 12.0 percent rate compounded annaully or 6.0% rate compounded semi-annually or 3 percent rate compounded quarterly. For the values of fractional time periods or interest rates not included in an interest table, linear interpolation may normally be used. If more precision is required, either a calculator or log tables can be used to get the answer.

10.7 TIME VALUE OF MONEY AND MANAGERIAL DECISIONS

The concept of time value of money figures in many day-to-day decisions. For example, in the vital decision making areas in management like the effective rate of interest on a business loan, the mortgage payment in a real estate transaction and evaluation of true return on investment etc., the time value of money plays an important role. Wherever use of money is involved and its inflow and outflow patterns are spread over a time horizon, this concept becomes very useful. For example, consider the following :

* A banker must establish the terms of loan.
* A finance manager is one who considers various alternative sources of funds in terms of the cost.
* A corporate planner must decide among various investment opportunities.
* A portfolio manager is one who evaluates various securities.
* An individual is one who confronts with a host of daily financial problems ranging from personal credit to management of major purchase decisions.

Primary goal of any financial manager is to maximise value of the firm. The value of a firm is influenced by vital decisions like capital budgeting, cost of capital, working capital management, mergers and acquisitions, lease or buy decisions etc. in which the concept of time value of money has a prime role to play.

10.8 STEP-BY-STEP PROCEDURE FOR SOLVING THE TIME VALUE RELATED PROBLEMS

Though financial calculators and computers provide quick solution to time value related problems, structuring the problems plays important role. Though financial calculations are efficient, they may pose a danger in the sense that people may sometimes copy style without understanding the logical process that under the calculations. When confronted with new solutions/problem students may find it difficult to solve them. Hence, understanding/undergoing the basic problem and the concepts involved play an important role. The following procedure may be adopted in solving the time value related problem :

Step I : Identify the two kinds as cash flows and their components.

Step II : Illustrate each problem on a time line.

Step III : Plot cash flow components on the time line.

Step IV : Select the base point of time to perform analysis.

Step V : Draw arrows from each cash flow component to the base point of time.

Step VI : Determine which of the cash flow components are to be used in present value and future value.

Step VII : Find the total value of cash inflow and out flow components as of the base point of time and equate them to each other.

10.8.1 Examples of Time Value Problems Worked Out

The following examples of time value related problems will make the concept clear :

Example 10.1

A father, employed in a private firm whose son is eight years old is concerned about the rising cost of higher education for his son. He has the following two goals to be met :

(a) to have (Rs. 10000 a year for 4 years to cover the son's college education. These funds will be needed when the boy's age is 18, 19, 20 and 21 years.

(b) to have a retirement income of Rs. 70000 per year for 20 years after 25 years from now (i.e. in years 26 through 45).

Currently, the father has Rs. 10000 who plans to save an annual equal amount each year in years 1 through 25. We assume that the father earns 7% per year compounded once in a year in current and future investment. What amount must be saved each year in years 1 through 25 in order to meet these goals ?

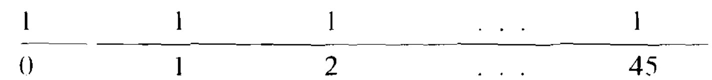
The solution to this time value related problem is explained in the following steps :

Step I : Identification of cash inflow (CF_1) and cash outflow (CF_2) components

CF_1 : In this, there are two components. The first component is the funds needed for education (Rs. 10000 a year when the boy is 18, 19, 20 and 21, i.e. in years 10, 11, 12 and 13 projecting from now). The second component is retirement income of Rs. 70000 per year for 20 years from 25 years from now, i.e. in years 26 through 45.

CF_2 : This has two components. The first component is the Rs. 10000 available now. The second component is the unknown equal amounts to be saved in years 1 through 25.

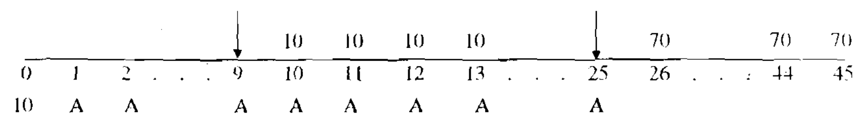
Step II : Illustrate each problem on a time scale. Draw a horizontal line and scale it to show different points of time covering the entire time period involved in the problem.



Scaling illustration

Step III : Plot CF_1 and CF_2 components on the time line.

CF_1 (in thousands)



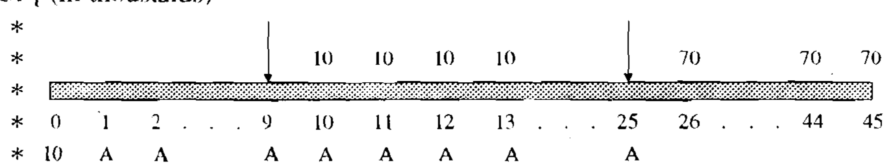
CF_2 (in thousands)

In the above illustration, the first component of CF_1 (son's education) is plotted at years 10 through 13. The second component of CF_1 (retirement income) is plotted at year 26 through 45. The first component of CF_2 (funds available now) is plotted at period 0 and the second component of CF_2 is plotted at years 1 through 25.

Step IV : Select a base point in time to perform analysis.

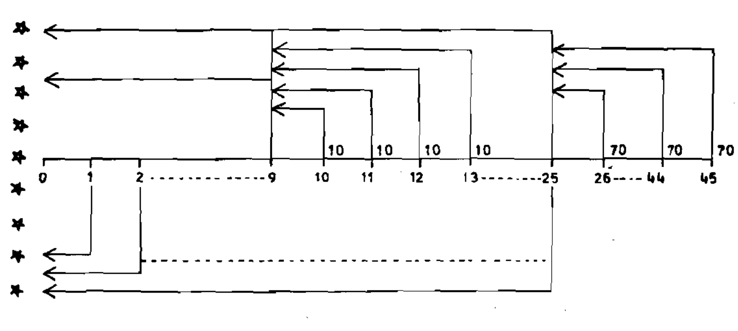
For comparative analysis of the present value and further value, a common base period wherein the values will be comparable should be chosen. In the above illustration, period zero (0) may be selected as the base point of time and hence, future values of both CF_1 and CF_2 should be converted into base period (0) value. There is no specific reason for selecting period 0 and any other point of time may be taken. The values will change accordingly. Plotting is done as follows where base period time (0) is denoted by * :

CF_1 (in thousands)



CF_2 (in thousands)

Step V : The above step is further elaborated by means of arrows as shown :



Step VI : Determination of the components of CF_1 and CF_2 which should be treated as further value or at present value.

Common principle on arrowing is that CF_1 and/or CF_2 components pointing to the left should be treated at the present value (PV) and those pointing to the right on future value (FV) . This will apply only when the base period chosen is in the middle path away from the base. If there is no arrow, it is neither PV nor FV, because it is already in terms of the present value. In the above example, both components of CF_1 are to be treated as a combination of present value of regular annuity and present value of lump sum. The value of first component of CF_2 is already in terms of period 0 and thus, it is net present value for any further value. The second component of CF_2 is to be treated as a present value of regular annuity (see graph in Step V).

Step VII : Find out the value of CF_1 components and CF_2 components of the base point of time and equate them to each other

This step involves finding value of each component of CF_1 as of the base point of time and value of each component of CF_2 as of the base point of time.

Now, add up all CF_1 components together and add all CF_2 components together. Then equate the total of CF_1 (as of the base point of time) to the total of CF_2 (as of the base point of time) and solve the unknown component of the cash flows. In the above example, given are annual interest rate (i) of 7%, the value of the cash flows in terms of the base point of time are as follows :

CF_1 as the base point of time period, i.e. 0

$$\text{Component 1} = 10000\,[PVIFA\,(0.07, 4)]\,[PVIF\,(0.07, 9)] \quad (\textit{See}\ \textbf{Note})$$
$$= 10000 \times (3.3872) \times (0.5439) = \text{Rs. } 18422.98$$
$$\text{Component 2} = 70000\,[PVIFA\,(0.07, 20)]\,[PVIF\,(0.07, 25)]$$
$$= 70000 \times (10.5940) \times (0.1842) = \text{Rs. } 136599.04$$

Total CF_1 as of period 0 = 18422.98 + 136599.04 = 155022.02

CF_2 as the base point of time period, i.e. 0

Component 1= 10000

Component 2 = A [PVIFA (0.07, 25)] = A (11.6536)

Total CF_1 as of period 0 = 10000 + 11.6536 A

As the base point of time period is same as 0, we have $CF_1 = CF_2$, which means,

Rs. 155022.02 = Rs. 10000 + 11.6536 A

On solving the above, we get, A = Rs. 12444.40

Hence, the annual amount needed to be saved to accomplish the father's twin goals are Rs. 12444.40.

Note :

PVIFA = Present Value Interest Factor for an Annuity

$$PVIFA\,(i, n) = \frac{1 - \dfrac{1}{(1+i)^n}}{i}$$

PVIF = Present Value Interest Factor

$$PVIF\,(i, n) = \frac{1}{(1+i)^n}$$

However, the values of PVIFA and PVIF may directly be determined from the Interest Tables given in Appendices II and III respectively.

Example 10.2

While you try to evaluate between an outright purchase and a lease decision, the concept of time value of money has an important role to play. Take the case of contractor requiring the use of a bulldozer only for a period of two years. If purchased, he expects to use the same for two years and hopes to sell at 80% of the purchase price. The cost of the bulldozer of Rs. 180000 can be financed to the extent of 80000 from his own sources and the balance at an interest rate of 18% per annum. The interest is payable annually at the end of each year and the loan can be repaid out of the proceeds of such a bulldozer.

For income tax purposes, the depreciation is admissible at 25% on diminishing balance method. Excess revaluation of any over WDV is subject to tax. The effective rate of tax for the contractor is 50%. The liabilities can be assumed to arise at the close of each year. The contractor expects minimum of return of 10% net of taxes on his own fund.

If hired, the same can be hired at the rate of Rs. 45000 per annum payable at the beginning of each year. The bulldozer for a service life of 10 years, operating costs are to be borne by the user. The buying vs leasing proportion can be evaluated by using time value concept. The time value charts will give you the value of Re. 1 discounted at a rate of 10% at the end of year 1 and year 2 as 0.909 and 0.826 respectively. Applying the same on the purchase decisions, we can work out as follows :

(A) Purchase Decision

I. Cash outflows :		**Amount**	**PV @ 10%**	**Discounted Value**
1.	One time investment (a)	80000	1.000	80000
2.	Interest on borrowings Ist year @ 18%, Tax 50%	9000	0.909	8181
3.	Interest on borrowings - II year	9000	0.826	7434
4.	Income tax on the bulldozer (b)	21375	0.826	17657
	Total	119375		113272
II. Cash inflows :				
1.	Cash received on sale of bulldozer (c)	44000	0.826	36344
2.	Savings in tax because of depreciation First year	22500	0.909	20453
3.	Savings in tax because of depreciation Second year (d)	16875	0.826	13939
	Total	83375		70736
Net discounted cash outflow = 113272 – 70736 = Rs. 42536.				

(B) Hiring/Leasing Decision

I. Cash outflows :		**Amount**	**PV @ 10%**	**Discounted Value**
1.	Hire charges I	45000	1.000	45000
2.	Beginning hence zero time Hire charges II	45000	0.909	40905
	Total	90000		85905
II. Cash inflows :				
	Tax savings in the (e) First year on hire charges	22500	0.909	20453
	Tax savings in the Second year on hire charges	22500	0.826	18585
	Total	45000		39038
Net discounted cash outflow = 85905 – 39038 = Rs. 46887.				

Evaluation

Present value of net outflows on purchase	Rs. 42536
Present value of net outflows on hiring/leasing	Rs. 46887

Hence, as present value of net outflows on purchase is higher for the contractor, purchasing proposition is advisable.

Working notes are as follows (references given in above table) :

(a) Net cash outflow is Rs. (180000 – 100000) = Rs 80000 only. Rs. 100000 is to be borrowed and repaid at the end of two years. Interest on borrowing is an outflow.

(b) Written down value of the bulldozer after two years is Rs. (180000 – 45000 – 33750) = Rs. 101250. Profit on sale is [Rs. 144000 (80% of purchase price) – Rs. 101250] = Rs. 42750. It is presumed that the tax on this profit is payable immediately at the end of 2 years.

(c)

Cash received on sale	Rs. 144000
Less loan	Rs. 100000
Net cash inflow	Rs. 44000

(d) Depreciation is Rs. 45000 and Rs. 33750 for the I and II year respectively. Tax saving would be 50% of these amounts.

(e) Hire charges will be paid in the beginning of the year and tax saving on the same will occur only at the end of the year.

The above illustrative examples would clear the applicability of the time value concept on important financial decision making areas of management.

SAQ 2

(a) Suppose someone offers you the following financial contract :

"If you deposit Rs. 20000 with him, he promises to pay Rs. 4000 annually for 10 years." What interest rate would you earn on this deposit ?

(b) Mr. Laxman receives a provident fund amount of Rs. 100000. He deposits in a bank which pays 10 percent interest. If he withdraws annually Rs. 20000, how long can he do so ?

10.9 SUMMARY

The time value of money figures in many day-to-day decisions from personal financial planning to corporate budgeting decisions. Interest represents the amount charged for the use of borrowed money. The financial market places, for either invested or borrowed funds include capital (long term) markets and money (short term) markets. The capital market is made up of primarily equities, mortgages and bonds. The money market includes treasury bills, commercial bank loans, commercial papers, bankers' acceptances and certificates of deposit. Each type of financial obligation came through interest rates determined by supply-demand relationships. The interest rate levels of the country have significant bearing on the nations economy. Changes in interest levels cause money to shift from one financial market to another.

From any business point of view, one of the most important factors is the use with which long term capital projects can be financed. The amount of interest associated with any type of financial transaction can be calculated by using one of the six standard interest formulae given as under :

(a) The component amount of single payment,

(b) The present value of future segments,

(c) The compound amount of an annuity,

(d) The sinking fund factor,

(e) The capital recovery factor, and

(f) The present value of an annuity.

In calculation of the interest rate, the frequency with which interest is compounded also bear an important influence on the total interest associated with an investment.

Despite its importance, the time value concept remains to be one of the most cumbersome subjects to students at all levels due to its complexity of the decision making process and the calculations involved.

10.10 ANSWERS TO SAQs

Refer the relevant preceding text in the unit or other useful books on the topic listed in the section "Further Reading" to get the answers of the SAQs.

APPENDIX - I

10 Percent Compound Interest Factor

N Periods	SINGLE PAYMENT		UNIFORM ANNUAL SERIES				N Periods
	Compound Amount Factor given P to find S	Present Worth Factor given S to find P	Sinking Fund Factor given S to find R	Capital Recovery Factor given P to find R	Compound Amount Factor given R to find S	Present Worth Factor given R to find P	
	$(1+i)^n$	$\frac{1}{(1+i)^n}$	$\frac{i}{(1+i)^n - 1}$	$\frac{i(1+i)^n}{(1+i)^n - 1}$	$\frac{(1+i)^n - 1}{i}$	$\frac{(1+i)^n - 1}{i(1+i)^n}$	
1	1.1000000	0.9090909	1.0000000	1.1000000	1.0000000	0.9090909	1
2	1.2100000	0.8264463	0.4761905	0.5761905	2.1000000	1.7355372	2
3	1.3310000	0.7513148	0.3021148	0.4021148	3.3100000	2.4868520	3
4	1.4641000	0.6830135	0.2154708	0.3154708	4.6410000	3.1698654	4
5	1.6105100	0.6209213	0.1637975	0.2637975	6.1051000	3.7907868	5
6	1.7715610	0.5644739	0.1296074	0.2296074	7.7156100	4.3552607	6
7	1.9487171	0.5131581	0.1054055	0.2054055	9.4871710	4.8684188	7
8	2.1435888	0.4665074	0.0874440	0.1874440	11.4358881	5.3349262	8
9	2.3579477	0.4240976	0.0736405	0.1736405	13.5794769	5.7590238	9
10	2.5937425	0.3855433	0.0627454	0.1627454	15.9374246	6.1445671	10
11	2.8531167	0.3504393	0.0539631	0.1539631	18.5311671	6.4950610	11
12	3.1384284	0.3186308	0.0467633	0.1467633	21.3842838	6.8136918	12
13	3.4522712	0.2896644	0.0407785	0.1407785	24.5227121	7.1033562	13
14	3.7974983	0.2633313	0.0357462	0.1357462	27.9749834	7.3666875	14
15	4.1772482	0.2393920	0.0314738	0.1314738	31.7724817	7.6060795	15

APPENDIX - II

PVIFA : Present Value Interest Factor for an Annuity

Period n	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%
0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909	0.901	0.893	0.885
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736	1.713	1.690	1.668
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487	2.444	2.402	2.361
4	3.904	3.808	3.717	3.360	3.546	3.465	3.387	3.312	3.240	3.170	3.102	3.037	2.974
5	1.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791	3.696	3.605	3.517
6	5.795	5.601	5.417	5.242	5.076	4.917	4.766	4.623	4.486	4.355	4.231	4.111	3.998
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868	4.712	4.564	4.423
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335	5.146	4.968	4.799
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759	5.537	5.328	5.132
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145	5.889	5.560	5.426
11	10.368	9.877	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.459	6.207	5.938	5.687
12	11.255	10.575	9.945	9.385	8.863	8.384	7.943	7.536	7.161	6.814	6.492	6.194	5.918
13	12.134	11.348	10.635	9.986	9.394	8.853	8.358	7.904	7.487	7.103	6.750	6.424	6.122
14	13.004	12.106	11.296	10.563	9.899	9.295	8.745	8.244	7.786	7.367	6.982	6.628	6.302
15	13.865	12.840	11.938	11.118	10.380	9.712	9.108	8.559	8.060	7.606	7.191	6.811	6.462
16	14.718	13.578	12.561	11.652	10.838	10.106	9.447	8.851	8.312	7.824	7.379	6.974	6.604
17	15.562	14.292	12.166	12.166	11.274	10.477	9.763	9.122	8.544	8.022	7.549	7.120	6.729
18	16.398	14.992	17.754	12.659	11.690	10.828	10.059	9.372	8.756	8.201	7.702	7.250	6.840
19	17.226	15.678	14.324	13.134	12.085	11.158	10.336	9.604	8.950	8.365	7.839	7.366	6.938
20	18.046	16.351	14.877	13.590	12.462	11.470	10.594	9.818	9.128	8.514	7.963	7.469	7.025
25	22.023	19.523	17.413	15.622	14.094	12.783	11.654	10.675	9.823	9.077	8.422	7.843	7.330
30	25.808	22.397	19.600	17.292	15.373	13.765	12.409	11.258	10.274	9.427	8.694	8.055	7.496

APPENDIX - III

PVIF : Present Value Interest Factor

Period n	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%
0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.925	0.917	0.909	0.901	0.893	0.885
2	1.980	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826	0.812	0.797	0.783
3	2.971	0.924	0.915	0.889	0.864	0.840	0.816	0.794	0.772	0.751	0.731	0.712	0.693
4	3.961	0.924	0.889	0.855	0.823	0.792	0.763	0.735	0.708	0.683	0.659	0.636	0.613
5	1.951	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621	0.593	0.567	0.543
6	0.942	0.888	0.838	0.790	0.746	0.705	0.666	0.630	0.596	0.564	0.535	0.507	0.480
7	0.933	0.871	0.813	0.760	0.711	0.665	0.623	0.583	0.547	0.513	0.482	0.452	0.425
8	0.923	0.853	0.789	0.731	0.677	0.627	0.582	0.540	0.502	0.467	0.434	0.404	0.376
9	0.914	0.837	0.766	0.703	0.645	0.592	0.544	0.500	0.460	0.424	0.391	0.361	0.333
10	0.905	0.820	0.744	0.676	0.614	0.558	0.508	0.463	0.422	0.386	0.352	0.322	0.295
11	0.895	0.804	0.722	0.650	0.585	0.527	0.475	0.429	0.388	0.350	0.317	0.287	0.261
12	0.788	0.871	0.701	0.625	0.557	0.497	0.444	0.397	0.356	0.319	0.286	0.257	0.231
13	0.879	0.773	0.681	0.601	0.530	0.469	0.415	0.368	0.326	0.290	0.258	0.229	0.204
14	0.870	0.758	0.661	0.577	0.505	0.442	0.388	0.340	0.299	0.263	0.232	0.205	0.181
15	0.861	0.743	0.642	0.555	0.481	0.417	0.362	0.315	0.275	0.239	0.209	0.183	0.160
16	0.853	0.728	0.623	0.534	0.458	0.394	0.339	0.292	0.252	0.218	0.188	0.163	0.141
17	0.844	0.714	0.605	0.513	0.436	0.377	0.311	0.270	0.231	0.198	0.170	0.146	0.125
18	0.836	0.700	0.587	0.494	0.416	0.350	0.296	0.250	0.212	0.180	0.153	0.130	0.111
19	0.828	0.686	0.570	0.475	0.396	0.331	0.276	0.232	0.194	0.164	0.138	0.116	0.098
20	0.820	0.673	0.554	0.456	0.377	0.312	0.258	0.215	0.178	0.149	0.124	0.104	0.087
25	0.780	0.610	0.478	0.375	0.295	0.233	0.184	0.146	0.116	0.092	0.074	0.059	0.047
30	0.742	0.552	0.412	0.308	0.231	0.174	0.131	0.099	0.075	0.057	0.044	0.033	0.026