CHAPTER 1

Basic Concept of Time Value of Money

1.1 INTRODUCTION

Money has time value. A rupee today is more valuable than a year hence. It is on this concept "the time value of money" is based. The recognition of the time value of money and risk is extremely vital in financial decision making.

Most financial decisions such as the purchase of assets or procurement of funds, affect the firm's cash flows in different time periods. For example, if a fixed asset is purchased, it will require an immediate cash outlay and will generate cash flows during many future periods. Similarly if the firm borrows funds from a bank or from any other source, it receives cash and commits an obligation to pay interest and repay principal in future periods. The firm may also raise funds by issuing equity shares. The firm's cash balance will increase at the time shares are issued, but as the firm pays dividends in future, the outflow of cash will occur. Sound decision-making requires that the cash flows which a firm is expected to give up over period should be logically comparable. In fact, the absolute cash flows which differ in timing and risk are not directly comparable. Cash flows become logically comparable when they are appropriately adjusted for their differences in timing and risk. The recognition of the *time value of money* and risk is extremely vital in financial decision-making. If the timing and risk of cash flows is not considered, the firm may make decisions which may allow it to miss its objective of maximising the owner's welfare. The welfare of owners would be maximised when *Net Present Value* is created from making a financial decision. It is thus, time value concept which is important for financial decisions.

Thus, we conclude that time value of money is central to the concept of finance. It recognizes that the value of money is different at different points of time. Since money can be put to productive use, its value is different depending upon when it is received or paid. In simpler terms, the value of a certain amount of money today is more valuable than its value tomorrow. It is not because of the uncertainty involved with time but purely on account of timing. The difference in the value of money today and tomorrow is referred as time value of money.

1.2 REASONS FOR TIME VALUE OF MONEY

Money has time value because of the following reasons:

1. **Risk and Uncertainty :** Future is always uncertain and risky. Outflow of cash is in our control as payments to parties are made by us. There is no certainty for future cash inflows. Cash inflows is dependent out on our Creditor, Bank etc. As an individual or firm is not certain about future cash receipts, it prefers receiving cash now.
2. **Inflation:** In an inflationary economy, the money received today, has more purchasing power than the money to be received in future. In other words, a rupee today represents a greater real purchasing power than a rupee a year hence.
3. **Consumption:** Individuals generally prefer current consumption to future consumption.
4. **Investment opportunities:** An investor can profitably employ a rupee received today, to give him a higher value to be received tomorrow or after a certain period of time.

Thus, the fundamental principle behind the concept of time value of money is that, a sum of money received today, is worth more than if the same is received after a certain period of time. For example, if an individual is given an alternative either to receive ₹ 10,000 now or after one year, he will prefer ₹ 10,000 now. This is because, today, he may be in a position to purchase more goods with this money than what he is going to get for the same amount after one year.

Thus, time value of money is a vital consideration in making financial decision. Let us take some examples:

Example 1: A project needs an initial investment of ₹ 1,00,000. It is expected to give a return of ₹ 20,000 per annum at the end of each year, for six years. The project thus involves a cash outflow of ₹ 1,00,000 in the 'zero year' and cash inflows of ₹ 20,000 per year, for six years. In order to decide, whether to accept or reject the project, it is necessary that the Present Value of cash inflows received annually for six years is ascertained and compared with the initial investment of ₹ 1,00,000.

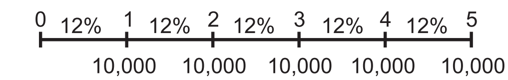
The firm will accept the project only when the Present Value of cash inflows at the desired rate of interest exceeds the initial investment or at least equals the initial investment of ₹ 1,00,000.

Example 2: A firm has to choose between two projects. One involves an outlay of ₹ 10 lakhs with a return of 12% from the first year onwards, for ten years. The other requires an investment of ₹ 10 lakhs with a return of 14% per annum for 15 years commencing with the beginning of the sixth year of the project. In order to make a choice between these two projects, it is necessary to compare the cash outflows and the cash inflows resulting from the project. In order to make a meaningful comparison, it is necessary that the two variables are strictly comparable. It is possible only when the time element is incorporated in the relevant calculations. This reflects the need for comparing the cash flows arising at different points of time in decision-making.

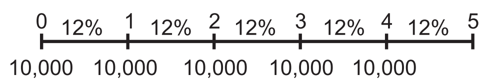
1.3 TIMELINES AND NOTATION

When cash flows occur at different points in time, it is easier to deal with them using a timeline. A timeline shows the timing and the amount of each cash flow in cash flow stream. Thus, a cash flow stream of ₹ 10,000 at the end of each of the next five years can be depicted on a timeline like the one shown below.

Part A



Part B



As shown above, 0 refers to the present time. A cash flow that occurs at time 0 is already in present value terms and hence does not require any adjustment for time value of money. You must distinguish between a period of time and a point of time[1]. Period 1 which is the first year is the portion of timeline between point 0 and point 1. The cash flow occurring at point 1 is the cash flow that occurs at the end of period 1. Finally, the discount rate, which is 12 per cent in our example, is specified for each period on the timeline and it may differ from period to period. If the cash flow occurs at the beginning, rather than the end of each year, the timeline would be as shown in Part *B*. Note that a cash flow occurring at the end of the year 1 is equivalent to a cash flow occurring at the beginning of year 2. Cash flows can be positive or negative. A positive cash flow is called a cash inflow; and a negative cash flow, a cash outflow.

1. Chandra, Prasanna, *Financial Management–Theory and Practice*, Fifth edition, TMH Publishing Company Ltd., New Delhi, p. 72.

1.4 VALUATION CONCEPTS

The time value of money establishes that there is a preference of having money at present than a future point of time. It means

(*a*) That a person will have to pay in future more, for a rupee received today. *For example* : Suppose your father gave you ₹ 100 on your tenth birthday. You deposited this amount in a bank at 10% rate of interest for one year. How much future sum would you receive after one year? You would receive ₹ 110

$$\text{Future sum} = \text{Principal} + \text{Interest}$$
$$= 100 + 0.10 \times 100$$
$$= ₹\ 110$$

What would be the future sum if you deposited ₹ 100 for two years? You would now receive interest on interest earned after one year.

$$\text{Future sum} = 100 \times 1.10^2$$
$$= ₹\ 121$$

We express this procedure of calculating as Compound Value or Future Value of a sum.

(*b*) A person may accept less today, for a rupee to be received in the future. Thus, the inverse of compounding process is termed as discounting. Here we can find the value of future cash flow as on today.

1.5 TECHNIQUES OF TIME VALUE OF MONEY

There are two techniques for adjusting time value of money. They are:

1. Compounding Techniques/Future Value Techniques
2. Discounting/Present Value Techniques

The value of money at a future date with a given interest rate is called future value. Similarly, the worth of money today that is receivable or payable at a future date is called Present Value.

Compounding Techniques/Future Value Technique

In this concept, the interest earned on the initial principal amount becomes a part of the principal at the end of the compounding period.

For Example: Suppose you invest ₹ 1000 for three years in a saving account that pays 10 per cent interest per year. If you let your interest income be reinvested, your investment will grow as follows:

First year	:	Principal at the beginning	1,000
		Interest for the year (₹ 1,000 × 0.10)	100
		Principal at the end	1,100
Second year	:	Principal at the beginning	1,100
		Interest for the year (₹ 1,100 × 0.10)	110
		Principal at the end	1210
Third year	:	Principal at the beginning	1210
		Interest for the year (₹ 1210 × 0.10)	121
		Principal at the end	1331

This process of compounding will continue for an indefinite time period.

The process of investing money as well as reinvesting interest earned there on is called *Compounding*. But the way it has gone about calculating the future value will prove to be cumbersome if the future value over long maturity periods of 20 years to 30 years is to be calculated.

A generalised procedure for calculating the future value of a single amount compounded annually is as follows:

Formula: $\boxed{FV_n = PV(1 + r)^n}$

In this equation $(1 + r)^n$ is called the future value interest factor (FVIF).

where, FV_n = Future value of the initial flow n year hence

PV = Initial cash flow

r = Annual rate of Interest

n = number of years

By taking into consideration, the above example, we get the same result.

$$FV_n = PV\,(1 + r)^n$$
$$= 1{,}000\,(1.10)^3$$
$$FV_n = 1331$$

To solve future value problems, we consult a future value interest factor (FVIF) table. The table shows the future value factor for certain combinations of periods and interest rates. To simplify calculations, this expression has been evaluated for various combination of ‘r’ and ‘n’. Exhibit 1.1 presents one such table showing the future value factor for certain combinations of periods and interest rates.

Continued of Time Value of Money

Exhibit 1.1 Value of $FVIF_{r,\,n}$ for various combinations of r and n

n/r	6%	8%	10%	12%	14%
2	1.124	1.166	1.210	1.254	1.300
4	1.262	1.360	1.464	1.574	1.689
6	1.419	1.587	1.772	1.974	2.195
8	1.594	1.851	2.144	2.476	1.853
10	1.791	2.159	2.594	3.106	3.707
12	2.012	2.518	3.138	3.896	4.817

Future Value of A Single Amount (Lumpsum)

The formula for calculating the Future Value of a single amount is as follows:

$$FV_n = PV\,(1 + r)^n$$

Illustration 1: If you deposit ₹ 55,650 in a bank which is paying a 12 per cent rate of interest on a ten-year time deposit, how much would the deposit grow at the end of ten years?

Solution: $FV_n = PV(1 + r)^n$ or $FV_n = PV(\text{FVIF}_{12\%,10\text{ yrs}})$

$$FV_n = ₹\ 55,\ 650\ (1.12)^{10}$$

$$= ₹\ 55{,}650 \times 3.106 = ₹\ 1{,}72{,}848.90$$

1.6 MULTIPLE COMPOUNDING PERIODS

Interest can be compounded monthly, quarterly and half-yearly. If compounding is quarterly, annual interest rate is to be divided by 4 and the number of years is to be multiplied by 4. Similarly, if monthly compounding is to be made, annual interest rate is to be divided by 12 and number of years is to be multiplied by 12.

The formula to calculate the compound value is

$$FV_n = PV\left(1+\frac{r}{m}\right)^{m\times n}$$

where, FV_n = Future value after 'n' years

PV = Cash flow today

r = Interest rate per annum

m = Number of times compounding is done during a year

n = Number of years for which compounding is done.

Illustration 2: Calculate the compound value when ₹ 1000 is invested for 3 years and the interest on it is compounded at 10% p.a. semi-annually.

SOLUTION: The formulae is

$$FV_n = PV\left(1+\frac{r}{m}\right)^{m\times n}$$

$$= 1000 \times \left(1 + \frac{.10}{2}\right)^{2\times 3}$$

$$= ₹\ 1340$$

OR

The compound value of Re. 1 at 5% interest at the end of 6 years is ₹ 1.340. Hence the value of ₹ 1000 using the table ($FVIF_{r,\ n}$) will be

$$FV_n = 1000 \times 1.340$$

$$= ₹\ 1,340$$

ILLUSTRATION 3: Calculate the compound value when ₹ 10,000 is invested for 3 years and interest 10% per annum is compounded on quarterly basis.

SOLUTION: The formulae is

$$FV_n = PV\left(1+\frac{r}{m}\right)^{m\times n}$$

$$= 10,000\left(1+\frac{.10}{4}\right)^{4\times 3}$$

$$= 10,000\ (1 + 0.025)^{12}$$

$$= ₹\ 13,448.89$$

ILLUSTRATION 4: Mr. Ravi Prasad and Sons invests ₹ 500, ₹ 1,000, ₹ 1,500, Rs 2,000 and ₹ 2,500 at the end of each year. Calculate the compound value at the end of the 5^{th} year, compounded annually, when the interest charged is 5% per annum.

SOLUTION: Statement of the compound value

End of the Year	**Amount Deposited**	**Number of Years Compounded**	**Compounded Interest Factor ($FVIF_{r,\ n}$) from Appendix**	**Future Value**
(1)	**(2)**	**(3)**	**(4)**	**(2) × (4)**
1	500	4	1.216	608.00
2	1,000	3	1.158	1,158.00
3	1,500	2	1.103	1,654.50
4	2,000	1	1.050	2,100.00
5	2,500	0	1.000	2,500.00
Amount at the end of 5^{th} year is Future Value =				**8020.50**

1.7 FUTURE VALUE OF MULTIPLE CASH FLOWS

The above illustration is an example of multiple cash flows.

The transactions in real life are not limited to one. An investor investing money in instalments may wish to know the value of his savings after '*n*' years. The formulae is

$$FV_n = PV\left(1+\frac{r}{m}\right)$$

where FV_n = Future value after '*n*' years
PV = Present value of money today
r = Interest rate
m = Number of times compounding is done in a year.

1.8 EFFECTIVE RATE OF INTEREST IN CASE OF MULTI-PERIOD COMPOUNDING

Effective interest rate brings all the different bases of compounding such as yearly, half-yearly, quarterly, and monthly on a single platform for comparison to select the beneficial base. Now, the question is which works out highest interest amount? When interest is compounded on half-yearly basis, interest amount works out more than the interest calculated on yearly basis. Quarterly compounding works out more than half-yearly basis. Monthly compounding works out more than even quarterly compounding. So, if compounding is more frequent, then the amount of interest per year works out more. Now, we want to equate them for comparison.

Suppose, an option is given as the following:

Basis of Compounding	**Interest Rate**
Yearly	10%
Half-yearly	9.5%
Quarterly	9%
Monthly	8.5%

Now, the question is which basis of compounding is to be accepted to get the highest interest rate. The answer is to calculate 'Effective Interest Rate'.

The formulae to calculate the Effective Interest Rate is

$$EIR = \left(1+\frac{r}{m}\right)^m - 1$$

where EIR = Effective Rate of Interest
r = Nominal Rate of Interest (Yearly Interest Rate)
m = Frequency of compounding per year

Take nominal interest rate as the base and find-out the comparable rate of interest for half-yearly, quarterly and monthly basis and select that which is most attractive.

ILLUSTRATION 5:

(*i*) A company offers 12% rate of interest on deposits. What is the effective rate of interest if the compounding is done on

(*a*) Half-yearly

(*b*) Quarterly

(*c*) Monthly

(*ii*) As an alternative, the following rates of interest are offered for choice. Which basis gives the highest rate of interest that is to be accepted?

Basis of Compounding	Interest Rate
Yearly	12%
Half-yearly	11.75%
Quarterly	11.50%
Monthly	11.25%

SOLUTION:

(*i*) The formula for calculation of effective interest is as below:

$$EIR = \left(1 + \frac{r}{m}\right) - 1$$

(*A*) When the compounding is done on half-yearly basis:

$$EIR = \left[\left(1 + \frac{.12}{2}\right)^2 - 1\right]$$

$$= 1.1236 - 1$$

$$= 12.36\%$$

(*B*) When the compounding is done on quarterly basis

$$EIR = \left[1 + \frac{.12}{4}\right]^4 - 1$$

$$= 0.1255$$

$$= 12.55\%$$

(*C*) When the compounding is done on monthly basis

$$EIR = \left[1 + \frac{.12}{12}\right]^{12} - 1$$

$$= 0.1268$$

$$= 12.68\%$$

Basis of Compounding	Interest Rate	EIR
Yearly	12%	12%
Half-yearly	12%	12.36%
Quarterly	12%	12.55%
Monthly	12%	12.68%

(*ii*) When the compounding is done on half-yearly basis

$$EIR = \left[1+\frac{.1175}{2}\right]^2 - 1$$
$$= 0.1209$$
$$= 12.09\%$$

When the compounding is done on quarterly basis:

$$EIR = \left[1+\frac{0.1150}{4}\right]^4 - 1$$
$$= .1200$$
$$= 12\%$$

When the compounding is done on monthly basis

$$EIR = \left[1+\frac{0.1125}{12}\right]^{12} - 1$$
$$= 0.1184$$
$$= 11.84\%$$

Thus, out of all interest rate, interest rate of 11.75% on half-yearly compounding works out to be the highest effective interest rate *i.e.*, 12.09% so this option is to be accepted.

ILLUSTRATION 6: Find out the effective rate of interest, if nominal rate of interest is 12% and is quarterly compounded.

SOLUTION:

$$EIR = \left[\left(1+\frac{r}{m}\right)^m - 1\right]$$
$$= \left[\left(1+\frac{.12}{4}\right)^4 - 1\right]$$
$$= [(1 + 0.03)^4 - 1]$$
$$= 1.126 - 1$$
$$= 0.126$$
$$= 12.6\% \text{ p.a.}$$

Growth Rate

The compound rate of growth for a given series for a period of time can be calculated by employing the future value interest factor table (*FVIF*)

EXAMPLE:

Years	Profit (in Lakhs)
1	95
2	105
3	140
4	160
5	165
6	170

How is the compound rate of growth for the above series determined? This can be done in two steps:

(*i*) The ratio of profits for year 6 to year 1 is to be determined *i.e.*,

$$\frac{170}{95} = 1.79$$

(*ii*) The $FVIF_{r,n}$ table is to be looked at. Look at a value which is close to 1.79 for the row for 5 years. The value close to 1.79 is 1.762 and the interest rate corresponding to this is 12%. Therefore, the compound rate of growth is 12 per cent.

1.9 DISCOUNTING OR PRESENT VALUE CONCEPT

Present value is the exact opposite of future value. The present value of a future cash inflow or outflow is the amount of current cash that is of equivalent value to the decision maker. The process of determining present value of a future payment or receipts or a series of future payments or receipts is called *discounting*. The compound interest rate used for discounting cash flows is also called the discount rate. In the next chapter, we will discuss the net present value calculations.

1.10 SIMPLE AND COMPOUND INTEREST

In compound interest, each interest payment is reinvested to earn further interest in future periods. However, if no interest is earned on interest, the investment earns only simple interest. In such a case, the investment grows as follows:

Future value = Present value [1 + Number of years × Interest rate]

For example, if ₹ 1,000 is invested @ 12% simple interest, in 5 years it will become

$$1{,}000\ [1 + 5 \times 0.12] = ₹\ 1{,}600$$

The following table reveals how an investment of ₹ 1,200 grows over time under simple interest as well as compound interest when the interest rate is 12 per cent. From this table, we can feel the power of compound interest. As Albert Einstein once remarked, " I don't know what the seven wonders of the world are, but I know the eighth – the compound interest. You may be wondering why your ancestors did not display foresight. Hopefully, you will show concern for your posterity."

Value of ₹ 1,000 invested at 10% simple and compound interest

Year	**Simple Interest**	**Compound Interest**
	Starting Balance + Interest = Ending Balance	**Starting Balance + Interest = Ending Balance**
1	1,000 + 100 = 1,100	1,000 + 100 = 1,100
5	1,400 + 100 = 1,500	1,464 + 146 = 1,610
10	1,900 + 100 = 2,000	2,358 + 236 = 2,594
20	2,900 + 100 = 3,000	6,116 + 612 = 6,728
50	5,900 + 100 = 6,000	1,06,718 + 10672 = 11,7,390
100	10,900 + 100 = 11,000	1,25,27,829 + 12,52,783 = 1,37,80,612

ILLUSTRATION 7: Mr. Rahul has deposited ₹ 1,00,000 in a saving bank account at 6 per cent simple interest and wishes to keep the same, for a period of 5 years. Calculate the accumulated Interest.

SOLUTION:

$$S_1 = P_0\ (I)\ (n)$$

where
S_1 = Simple interest
P_0 = Initial amount invested
I = Interest rate
n = Number of years

$$S_1 = ₹\ 1{,}00{,}000 \times 0.06 \times 5 \text{ years}$$

$$S_1 = ₹\ 30{,}000$$

If the investor wants to know his total future value at the end of 'n' years. Future value is the sum of accumulated interest and the principal amount.

Symbolically

$$FV_n = P_0 + P_0(I)\ (n)$$

OR

$$S_1 + P_0$$

ILLUSTRATION 8: Mr. Krishna's annual savings is ₹ 1,000 which is invested in a bank saving fund account that pays a 5 per cent simple interest. Krishna wants to know his total future value or the terminal value at the end of a 8 years time period.

SOLUTION:
$$FV_n = P_0 + P_0\,(I)\,(n)$$
$$= ₹\ 1000 + ₹\ 1000\ (0.05)\ (8)$$
$$= ₹\ 14{,}000$$

Compound Interest

ILLUSTRATION 9: Suppose Mr. Jai Singh Yadav deposited ₹ 10,00,000 in a financial institute which pays him 8 percent compound interest annually for a period of 5 years. Show how the deposit would grow.

SOLUTION:
$$FV_5 = P_0\,(1 + I)^8$$
$$FV_5 = 10{,}00{,}000\ (\ 1 + 0.08)^5$$
$$= 10{,}00{,}000\ (1.469)$$
$$FV_5 = ₹\ 14{,}69{,}000$$

Note: See compound value of one rupee Table for 5 years at 8% interest.

Variable Compounding Periods/Semi-annual Compounding

ILLUSTRATION 10: How much does a deposit of ₹ 40,000 grow in 10 years at the rate of 6% interest and compounding is done semi-annually. Determine the amount at the end of 10 years.

SOLUTION:
$$FV_{10} = P_0\left(1+\frac{I}{2}\right)^{24}$$
$$= \text{Rs. } 40{,}000\left(1+\frac{0.06}{2}\right)^{2\times 10}$$
$$= ₹\ 40{,}000\ (1.806)$$
$$= \text{Rs. } 72{,}240$$

Alternatively, see the compound value for one rupee table for year 20 and 3% interest rate.

ILLUSTRATION 11: (Quarterly compounding): Suppose a firm deposits ₹ 50 lakhs at the end of each year, for 4 years at the rate of 6 per cent interest and compounding is done on a quarterly basis. What is the compound value at the end of the 4th year?

SOLUTION:
$$FV_4 = P_0\left(1+\frac{I}{4}\right)^{4\times n}$$
$$= \text{Rs. } 50{,}00{,}000\left(1+\frac{6}{4}\right)^{4\times 4}$$
$$= ₹\ 50{,}00{,}000 \times 1.267$$
$$= ₹\ 63{,}35{,}000$$

Compound Growth Rate

Formula: $g_r = V_0 (1 + r)^n = V_n$

where, g_r = Growth rate in percentages

V_0 = Variable for which the growth rate is needed

V_n = Variable value (amount) at the end of year 'n'

$(1 + r)^n$ = Growth rate.

ILLUSTRATION 12: From the following dividend data of a company, calculate compound rate of growth for 2003–2008.

Year	Dividend per Share (₹)
2003	21
2004	22
2005	25
2006	26
2007	28
2008	31

SOLUTION:

$$g_r = V_0 (1 + r)^n = V_n$$
$$= 21 (1 + r)^5 = 31$$
$$= (1 + r)^5 = \frac{31}{21} = 1.476$$

Alternatively, the compound value one Rupee table for 5 years should be seen till closed value to the compound factor is found. After finding the closest value, first above it is seen to get the growth rate.

THEORETICAL QUESTIONS

1. What do you mean by time value of money?
2. What is the difference between compound and simple interest?
3. Why is the consideration of time important in financial decision-making? How can time be adjusted? Illustrate your answer.
4. Explain the meaning and importance of valuation concept. How does valuation concept help in decision making?
5. Distinguish between
   (*a*) Compounding and Discounting technique
   (*b*) Effective and Nominal rate of interest
6. "A bird in hand is more preferable than two birds in the bush." Explain.
7. State the relationship between effective rate of interest and the nominal rate of interest.
8. What is multi-period compounding? How does it affect the annual rate of interest? Give an example.

9. "A rational human being has a time preference for money." Give reasons.

10. Explain the discounting and compounding technique of time value of money?

NUMERICAL PROBLEMS

1. Mr. Jitendra deposited ₹ 1,00,000 in a saving bank account today, at 5 per cent simple interest for a period of 5 years. What is his accumulated interest? [**Ans.** ₹ 2500]

2. Determine the future value of ₹ 1,00,000 if you invest in a bank for 5 years at 6% rate of interest. [**Ans.** ₹ 1,33,800]

3. Mr. Abhisekh deposits ₹ 5,00,000 for a period of 10 years at 10% rate of interest. What would be the value of his sum after 10 years? [**Ans.** ₹ 12,97,000]

4. Mr. Dhiraj deposits ₹ 1,00,000 at the end of each year for 10 years. What will be the value of his money at the end of 10 years at (*a*) 9%, (*b*) 10% and (*c*) 12%?

[**Ans.** (*a*) ₹ 15,19,300; (*b*) ₹ 15,93, 700; (*c*) ₹ 17,54,900]

5. If you deposit ₹ 1,00,000 in a bank which provides an interest of 12% quarterly compounding is done. How much will the investment be after 5 years? [**Ans.** ₹ 1,80,611]

6. Mr. Raj deposits ₹ 10,00,000 and he receives ₹ 1,00,000 every year for the next 20 years. Find out the rate of interest being offered to the investor. [**Ans.** 7.6% approx.]

7. Suppose you deposit ₹ 1,00,000 with an investment company, which pays 10 per cent interest with semi-annual compounding. What is the total deposit amount at the end of the 5 years? [**Ans.** ₹ 1,21,900]

8. Mr. Singhania deposits at the end of each year ₹ 2,000, ₹ 3,000, ₹ 4,000, ₹ 5,000 and ₹ 6,000 for the consequent 5 years respectively. He wants to know his series of deposits value at the end of 5 years with 6 per cent rate of compound interest. [**Ans.** ₹ 21,893]

9. A borrower offers 16 per cent rate of interest with quarterly compounding. Determine the effective rate of interest. [**Ans.** 17%]

10. Mr. Gyan deposits ₹ 5,000 at the end of each year, at 8% per year. What amount will he receive at the end of 6 years? [**Ans.** ₹ 36,680]