UNIT 4 INTEREST RATES AND CASH FLOWS

Structure

4.0 OBJECTIVES

After going through the unit, you will be able to:

- Explain the idea behind the time value of money;
- Define the concept of cash flow streams;
- Explain the determination of interest rates in the economy;
- Discuss the theories of the term structure of interest rates; and
- Describe the methods of valuing cash flows and future interest rates.

4.1 INTRODUCTION

In the previous unit you were introduced to the concept of a financial asset. We looked in detail at the way the assets provide returns and the risks associated with these assets. We saw how the rational investor deals with the presence of uncertainty. We also learnt about Markowtz's portfolio theory, about Sharpe's Capital Asset Pricing Model and Ross's Arbitrage Pricing Theory.

In this unit we look at something that is actually more fundamental: we consider **fixed income** securities in a situation where there is no uncertainty. This essentially means we shall be considering various types of debt. This unit begins with the basic idea that a rupee today is worth more than a rupee tomorrow; however, there may be situations when you invest something today but get the returns in future. How the future streams of returns is valued in today's terms is what is discussed under the topic '**time value of money**'. The unit then goes on to a basic discussion of **cash flows** (the unit, as mentioned, considers only deterministic cash flows in the absence of uncertainty), and then explains how the returns on fixed income securities (the interest rate) is determined, and some of the main theories on this topic. Then the unit discusses what is called the term structure of interest rates. This refers to situations when varying terms to maturity of different debts lead to differences in yields. Do not worry. These topics are going to be explained in clear terms in a little while. Finally the unit discusses in detail the methods of valuing stream of cash flows and future interest rates.

Interest rates are a measure of the prices paid by a borrower (or debtor) to a lender (or creditor) for the use of resources during some time interval. The sum transferred from the lender to the borrower is called the principal and the price paid for the use is usually expressed as a percentage of the principal per unit of time (usually per year)

4.2 TIME VALUE OF MONEY

We usually prefer to consume in the present than in the future. A rupee today is psychologically worth more to us than a rupee tomorrow. This is even truer when inflation is present. Investors will postpone current consumption and invest only if their future opportunities are larger due to the investment. Since one can invest money and start earning interest immediately, a rupee today must be worth more than a rupee tomorrow. Investors are investing money and getting returns in the future in terms of money. This is called cash flow. When cash comes to us it is called a cash *in*flow and is considered a positive cash flow, and when we pay out cash it is called a cash *out*flow and is considered a negative cash flow.

We will discuss in detail the consumption-saving choice and the investment decisions that lead to the demand for and supply of loanable funds in the next section, but for now we will be setting out some basic mathematics for the computation of interest rates and cash flows.

Let us begin by compounding a single cash flow. Suppose you invest Rs. 100 in 2007. if this investment earned simple interest at the rate of 10% per year, the future value of your investment would be Rs 100 plus Rs 10 per year for every year that the amount was invested at 10% per year. If you invested Rs 100 for 4 years you would have Rs 140 at the end of 4 years. In general if you invest Rs P (P stands for principal) at r% per year for t years, at the end of t years you will get an amount

$$A = P + \Pr t = P(1 + rt)$$

Compound interest is more interesting! When investments are made at compound interest rates, the investment earns "interest on interest". In other words, interest is paid on interest that has been earned in previous periods. For the above example, after the first year, amount would be Rs 100 + Rs 10 (interest =105 of 100, =10) = Rs 110. at the beginning of the second period, this Rs 110 is invested and the interest now is 10% of 110, that is Rs 11. So after the second year, the amount goes up to Rs 110+ Rs 11 = Rs 121.

In general, if a principal P is invested at r percent compound interest for t years, the amount obtained at the end of t years is

$$A = P(1 + r)^t$$

notice the difference with the simple interest formula. There , the term within parentheses was 1+rt, that is t is multiplied by r and added to 1. In the case of compound interest, t appears not as a multiplicative term but as an exponent, so that (1+r) is raised to the power t.

We can restate the above by calculating the future value of a single cash flow compounded annually as follows:

Let C_0 be the initial cash flow or investment

r be stated annual rate of interest or return

n be life of investment

C_n be value of C_0 at end of n years.

Then,

$$C_n = C_0 \left(1+r\right)^t$$

The amount $\left(1+r\right)^t$ is called the future value compound factor, denoted $FVCF_{r,t}$ where the subscripts r and t have the meaning just alluded to. Thus

$$C_t = C_0 FVCF_{r,t}$$

Now we turn to the inverse process, that is, we want to find out, if the future cash flow is of a given amount, what would be the value of the cash flow today. We begin by considering a single period. To convert future cash value into present value, we use the procedure of discounting. To discount a future cash flow to the present, simply rearrange the equation for compounding, to get,

$$C_0 = \frac{C_t}{\left(1+r\right)^t}$$

Thus discounting is the opposite of compounding. In the above equation, $\frac{1}{\left(1+r\right)^t}$ is called the present value discount factor $PVDF_{r,t}$. The discount factor is simply the reciprocal of compound factor.

So far, we have considered the case of compounding or discounting a single cash flow. Most financial problems, however, are concerned with multiple cash flows. Let us just take up discounting. Discounting multiple cash flows is simple: we can discount each individual cash flow and then add the present values. The general case is present below (the cash flows are unequal and uneven each year)):

$$PV_0 = \frac{C_1}{\left(1+r\right)^1} + \frac{C_2}{\left(1+r\right)^2} + \ldots + \frac{C_t}{\left(1+r\right)^t}$$

We can now consider the present value of an annuity. An annuity consists of a constant payment received each year. Letting P_0 equal the present value of an annuity which pays C rupees at the end of each year for t years,

$$P_0 = \frac{C}{\left(1+r\right)} + \frac{C}{\left(1+r\right)^2} + \ldots + \frac{C}{\left(1+r\right)^t}$$

$$= C\left[\frac{1}{(1+r)^{1}}+\frac{1}{(1+r)^{2}}+\ldots+\frac{1}{(1+r)^{t}}\right]$$

The sequence of terms within the square brackets represents a geometric progression. The geometric progression is called the present value annuity factor ($PVAF_{r,t}$) at rate r and t years. Using this notation we can represent the present value of any annuity as

$$P_0 = C.PVAF_{r,t}$$

where C is the constant payment amount. It can be shown that the present-value annuity factor can be shown to be equal to

$$PVAF_{r,t} = \frac{1-\left[1\big/(1+r)^{t}\right]}{r}$$

We can derive the formula for the future value of an annuity. It can be shown to be

$$FVA_t = C(1+r)^{t-1} + C(1+r)^{t-2} + \ldots + C$$

This is equal to

$$C\left[(1+r)^{t}-1\right]/r$$

By way of concluding this section let us consider compounding and discounting when cash flow is not on a yearly basis but occurs more than one time a year. Suppose r is the interest rate, t the number of years, as before, but now suppose it is compounded m times a year, that is, m is the number of compounding periods in a year.

To find out the relevant formula for compounding in such cases, we find it is equal to

$$C_t = C_0\left(1+\frac{r}{m}\right)^{mt}$$

For the case of discounting, if there is non-annual discounting the formula is

$$C_0 = \frac{C_t}{\left(1+\frac{r}{m}\right)^{mt}}$$

Let us come back to compounding when there is non-annual compounding. We saw the formula is

$$C_t = C_0\left(1+\frac{r}{m}\right)^{mt}$$

Let us ask what happens when compounding takes place not only several times within a year but actually continuously. It may be hard to conceive but is of much use theoretically in economics. Let us divide and multiply the exponent by r. we get

$$C_t = C_0\left(1+\frac{r}{m}\right)^{\frac{m}{r}rt}$$

If compounding is done continuously, m will tend to infinity. Writing r/m as k, and knowing that m tends to infinity, so does k , we take the limit of the expression:

$$\lim_{k\to\infty}(1+k)^{krt} = \lim_{k\to\infty}\left[(1+k)^{k}\right]^{rt}$$

=ert, where e = 2.718, is the base for natural logarithm.

Check Your Progress 1

1) Why does money have time value?

....

....

....

....

....

2) What is the difference between simple and compound interest?

....

....

....

....

....

3) State the formulae for present value and future value of an annuity.

....

....

....

....

....

4.3 DETERMINATION OF INTEREST RATES

In this section we discuss the theory of interest rates and their determination. We cannot discuss financial markets without bringing in a discussion about interest rates. Interest rates are the basic price in financial markets. We basically focus on a specific type of interest rate that can serve as the benchmark for other rates. This is the short-term riskless real interest rate. By real rate is meant the rate of interest adjusted for inflation. Subsequently, especially in the next section, we will discuss other types of interest and see how these are related to this basic interest rate. This is what is called the structure of interest rate. We will look at the factors that influence the yield on bonds.

To theoretically understand the determination of interest rates, we must examine the saving-consumption decision. Saving reflects primarily the choice between current consumption and future consumption. To understand this choice, we must think back to basic microeconomic theory and think, as was the case in simple theory of the consumer, of preferences and opportunity. In basic consumer theory, preference was represented by indifference curves and opportunity by the budget constraint. We can think of indifference curves in this context as well: the only difference is to depict, instead of two goods diagrammatically, we can think of 'consumption today' (consumption in the current period) and 'consumption tomorrow' (consumption in the next period). Consumption tomorrow' or deferred consumption is nothing but saving. We can draw indifference curves as well. Here too the indifference curves will be convex to the origin, because as the consumer gives up successive equal amounts of current consumption, it will take higher and higher quantities of future consumption to make up for the loss of an additional unit. We can draw a tangent at any point on the indifference curve, with the slope of the tangent showing the marginal rate of substitution between current and future consumption. Irving Fisher, the great American economist who pioneered the microeconomic analysis of interest rates, called it the marginal rate of time preference. It measures how many additional units of consumption tomorrow have to be given to the consumer to compensate for the loss of one unit of consumption today.

We now need to combine preferences with opportunities available to the consumer. Let us assume that the consumer is endowed with a certain given combination of consumption today and consumption tomorrow. Let us further assume that here is a loan market where this consumer is free to lend or borrow at a fixed exchange rate of $R = 1+r$ and be able to exchange his initial or current endowment for a different one. Let P be the amount lent, and let r be the interest. Then $A = P(1+r)$ is the amount returned. Dividing by P, we get $A/P = 1+r$. This A/P is RLet or The opportunity locus (also called the market line) can be represented by a downward sloping straight line that is just like the budget constraint in standard consumer theory. The consumer's initial endowment of combination of consumption in the current and subsequent period can be represented by a point on the opportunity locus. To this line we add the family of indifference curves. There will be one curve that will be tangent to the market line. The consumption basket corresponding to this point of tangency can be shown to be the preferred one among all available ones, given the market line, and hence it will be the chosen one. This is the point of equilibrium. Thus the possibility of borrowing and lending at the given rate allows the consumer to reach a higher indifference curve. At the equilibrium point, the marginal rate of substitution is equal to the market rate. in a perfect market, everybody is confronted with the same market rate r, at equilibrium everybody has the same marginal rate of substitution. For simplicity, we have taken r as given, but demand and supply of funds will determine r in a market economy. For a given R, each person will decide her consumption-saving pattern. In a simple economy, deferred consumption, or saving, is the same as lending. By aggregating the net lending of each person who saves, for each R, we can get a supply curve of loans which will be an upward sloping function of R.

We have spoken till now of the **real rate** of interest. This rate measures the amount of commodity in the next period that can be exchanged for one unit of the commodity this period. This will be different from the **nominal rate**, which refers to the amount of *money* to be repaid next period per unit borrowed now. The two rates are related to each other by a relation called Fisher's Law. It basically asserts that an exchange between money now for money tomorrow must imply the same rate of exchange between the commodity now and later, as implied by the real rate. But instead of this, supposed we had sold the commodity off at the present price P_1 and invested the amount earned in a loan at the nominal rate (1+i) getting back P_1(1+i)

Assume that the real rate is 1+r; this means that by giving one unit of the commodity now we can get 1+r units of the commodity tomorrow. Let us see how much it represents in terms of commodity tomorrow. To do this we must divide by the price of commodity tomorrow, P_2. thus the second period quantity is $P_1 \frac{(1+i)}{P_2}$

This must equal the real rate (1+ r).

It can be shown that $r = i + \left(\frac{P_2 - P_1}{P_1} \right)$

Here the term in parentheses is the inflation rate.

Having looked at the basic theory of interest determination in a microeconomic saving-consumption theory, let us look at some other theories put forward to explain the *levels* of interest rates prevailing in an economy. We look at three basic theories: **the classical theory, Keynes's theory** and t**he loanable funds theory.** Let us start with Classical theory first.

The Classical theory is associated with Ricardo and Hume. Also, the basic neoclassical-type theory of the kind presented above was put forward by Irving Fisher and this too comes under Classical theory. For the Classical economists in the 18th, 19th and early 20th century, interest rates are a real phenomenon in the sense that the interest rate is determined by real factors. Monetary processes and factors do not into play at all in the determination of interest rate levels. It is merely the supply of saving and the demand for investment that determines the equilibrium rate of interest. Saving may be done by individuals, households, business firms, or the government. Saving is the excess of income over consumption, and given the level of income, there is a particular level of saving determined. Given the income, consumers and firms have a natural tendency to spend that income on current consumption, that is consumption now rather than later. There is a time preference for the present, as you just studied in the previous section (on time value of money—of course, the Classical economists were primarily speaking of real consumption of goods rather than money). Thus for consumers and firms, according too Classical theory, money now is valued more than money next year. Because of time preference or 'impatience', as Fisher put it, deferred consumption involves a 'sacrifice'. To induce these economic agents to make this sacrifice, they must be offered a reward. This reward is called the 'rate of interest'. Hence, interest is a reward for sacrifice, or abstinence, or 'waiting'. On the side of investment, that is, on the demand side, firms demand capital goods for to make profits by producing goods. Investment takes place because investing in more roundabout or indirect methods or process of production. The scope to produce more efficiently using roundabout methods of production determines investment demand. The saving as a function of the interest rate is an upward sloping curve, while investment as a function of interest rate is a downward sloping line. The intersection of the saving and investment curves gives the equilibrium rate of interest and the equilibrium amount of saving and investment in the economy. The interest rate so determined is called the 'natural' rate of interest. In a static situation, that is, at a point of time, this interest rate is not affected by monetary phenomena. Also, according to the classical theory, interest rates are not much affected by the actions and behaviour of banks and other credit institutions.

The Classical theory has certain shortcomings. The theory does not consider several dimensions of a modern economy like business fluctuations, and even financial markets! It is also restrictive because it assumes perfect competition and price flexibility. There may be many other factors in a modern economy that might affect the flow of funds and the interest rate.

Now we turn to the Lonable Funds theory. This theory of interest rate determination is in some sense similar in spirit to the Classical Theory but makes certain modifications to it. Basically, it suggests that a combination of real and monetary factors determine the interest rates. It suggests modifications to two basic points which the classical theory holds. The Classical theory suggested first, that although interest is paid in monetary terms on money loans and assets, the level of interest is not related to the level of money and prices. Secondly, the Classical theory holds that banks and other intermediaries merely channel savings to investors; they cannot influence the level of interest. It is these two propositions that the loanable funds joins issue with. The loanable funds theory discards the independence of the interest rates from the behaviour of money and banking. According to the loanable funds theory, to the real forces determining interest rates should be added a monetary component of saving associated with the creation of new money and credit. The supply of credit has a monetary component. This approach also gives banks and credit agencies some role in increasing the flow of loanable funds and thus putting downward pressure on the interest rates. The rate of interest clears the supply of saving plus credit.

We finally come to a discussion of the Keynesian theory of interest. The classical theory took one extreme position in assigning no role to monetary phenomena in the determination of interest rates and suggesting that interest rates are determined only by real forces. The Keynesian theory takes a completely opposite view: according to Keynes, interest is primarily a monetary phenomenon. The rate of interest is determined by the money supply and hence on monetary policy indirectly, and on the demand side it is influenced by the attitude of people towards holding of cash balances, and also on the motive for which such balances are held. In the Keynesian approach, interest is not the reward for time waiting or abstinence. It is the reward for inducing people to hold securities instead of cash. Interest is the difference between yield on safe cash and risky securities; it emerges as a price of inducing people to give up liquidity of holding money in favour of holding securities. The demand for holding money is called liquidity preference. You have read about the Keynesian theory of demand for money in the course MEC-002 on macroeconomics. There you read that there are three motives for holding money: the transactions motive, the precautionary motive and the speculative motive. It is the last motive, together with the role of expectations about future interest rates, which determines the interest rates, of course, with the money supply, too, playing a role. However, money supply is itself exogenous and under control of the monetary authorities. The demand for, and supply of, money determines the equilibrium interest rate. Increases in the supply of money or reduction in the demand for money lowers the interest rate.

Check Your Progress 2

1) What do you understand by the marginal rate of time preference?

....

....

....

....

....

2) Discuss the role of real forces of saving and investment in the determination of interest rates.

....

....

....

....

....

3) Compare and contrast the Loanable Funds, and Keynesian theories of the determination of interest rates.

....

....

....

....

....

4.4 TERM STRUCTURE OF INTEREST RATES

The theories of the determination of interest rates discussed above are mainly theoretical constructs that seek to provide an explanation of the level of the average, or natural rate of interest. These do not go very far in explaining the vast array and variety of interest rates prevailing in several different types of financial markets. We can ask: what explains the difference in the levels of long run and short-run interest rates? What explains the basic *structure* of interest rates? There are situations where different assets have different risks of default. For example the interest owed by a farmer to a moneylender may have a greater risk of not being paid (the loan to the farmer has a greater risk of default) than interest on a government bond. Differences in the level of risk of default can lead to differences in the rate of interest charged. The phrase 'term structure of interest rates' refers to the yields of interest-bearing instruments such as bonds which are equal except for maturity dates, that is, their terms to maturity differs.

We look at debts that are issued by lenders that are more or less identical; the only difference in the debt instrument is in the times at which these mature.

Differences in yield caused by differences in the maturity period are called the term structure of interest rates. We can depict graphically the relationship between interest rates of the debt instrument and their maturity period. This graphical relationship is called the yield curve. It summarises the yields that one can earn by purchasing otherwise identical debt instrument of varying maturities. Yield curves can be mapped for instruments such as Treasury Bills bonds, Certificates of Deposits etc. A yield curve is a picture at a certain moment of time. At a different time, the rate of interest may change and so may the yield curve. In a yield curve what we allow the maturity period to vary but hold constant the date at which the curve is relevant, as well as the default risk associated with the particular instrument. Yield curves are usually upward sloping. However in rare cases when the yields of different instruments do not vary much among each other, the yield curve may even be almost horizontal. Similarly in rarer situations when the yield on longer-term instruments is lower than the yield on shorter-term instruments, the yield curve may even be downward sloping. Historically, a few episodes of flat and even downward-sloping yield curves have occurred.

Now we discuss some theories about the explanations for the term structure of interest rates. We will discuss three theories that have been put forward: (i) **the expectations hypothesis**; (ii) **the segmented-market hypothesis**; and (iii) **the preferred-habitat hypothesis**. The first two are diametrically opposed, while the third combines elements of the other two. Let us discuss these one by one.

The expectations hypothesis asserts that longer-term interest rates are an average of the shorter-term interest rates expected to prevail over the life of the long-term asset. To make this assertion the theory assumes that investors perceive a series of short-term bonds as perfect substitutes for long-term bonds. Since investors consider short and long-term bonds as substitutes (in terms of quality) the only factor affecting the investor's decision is the expected return to be earned from purchasing a larger number of short-term bonds as compared to a single long-term one. The expectations hypothesis also assumes implicitly that investors are risk neutral and are not willing to pay a premium to lock-in a higher duration interest rate. It also assumes that there are no transactions costs either, so that the cost of buying a short-term asset is the same as buying a long-term asset.

The expectations theory says that the investor should expect to receive the same return from either investing in a n-period long-term bond, say, or the same amount in a i-year bond over a period of n years, that is, n times. Mathematically, it can be depicted as

$$\left(1+r_{1,n}\right)^{n}=\left(1+r_{1}\right)\left(1+Er_{2}\right)\ldots\left(1+Er_{n}\right)$$

where shows yield to maturity for a bond beginning in the current time period and maturing in period n. The left-hand-side of the above equation shows the future value of rupee one invested in an n-year bond, while the right-hand side represents the future value of rupee one invested in a series of 1-year bonds over a period of n years. Of course, the future one-period interest rates Er_2, Er_3, ...Er_n would be expected rates from the point of current time period.

Let us now come to the segmented-markets hypothesis of term-structure of interest rates. It is at the opposite end of the theoretical spectrum from the expectations theory. it says that bonds with different maturity periods are substitutable for each other; their yields are determined independently of each other. It views the markets for bonds with different maturities as separate. In each segment, the yield is determined by the intersection of demand and supply for that type of bond.

The idea behind the market segment hypothesis is that investors have preferences for financial instruments with particular terms to maturity. If a person has idle cash balances which he will not need for another seven years when he need it because he retires then, in that case the person will be attracted to and invest in bonds with a 7-year maturity period. Purchasing a holding a bond for seven years is more attractive for him than holding a bond for shorter period and then reselling and buying a bond subsequently because the transaction costs would be higher in the latter case. Also, the interest risk would be greater because in the future the interest may come down. On the other hand, if he holds a short period bond and the interest rate rose in the subsequent period then the price of bond will fall, leading to a capital loss for him when he sold the bond. The segmented-market hypothesis implies that the relative supply of and demand for bonds and other financial instruments of varying maturities determines the shape of the yield curve.

The segmented-markets theory has been criticised on two grounds. First, it is not very useful in predicting changes in the pattern of yields; it states only that changes in preferences for loans of varying maturities will determine the shape o f the yield curve. Secondly, the theory suggests that the long- and short-term rates are not related to each other. Contrary to this, evidence seems to suggest that long-term and short-term rates move together.

The preferred-habitat hypothesis combines the expectations hypothesis and the segmented-markets hypothesis. The central idea of the preferred habitat theory is that while investors have a preference for loanable funds of specific terms to maturity as suggested by the segmented markets hypothesis, investors are willing to substitute away from their preferred terms if they are compensated for doing so. This compensation that must be offered to investors to make them purchase a different term to maturity than their preferred terms is called the term premium. For this reason, the preferred habitat theory is sometimes called the **liquidity premium theory**. The rationale for the preferred habitat hypothesis is a combination of the rationale for the expectations hypothesis and the segmented-market hypothesis.

This hypothesis asserts that an investor will choose bonds on the basis of both the expected return of the bond and the investor's preference for bonds with a particular maturity. An investor will purchase a bond with maturity different from his desired one only if he receives a term premium. This term period is merely the additional yield that must be promised to the investor to induce him to purchase a bond with a term not in line with his initial preference. The expectations and segmented-market hypotheses are extreme forms of the preferred habitat theory. Under the expectation hypothesis, the term premium is effectively zero, while under the segmented-market hypothesis the term premium is effectively infinite.

Since the preferred habitat hypothesis combines the expectations hypothesis and segmented-markets hypothesis it has great power to explain the shapes of yield curves. It can explain not only upward sloping yield curves but also flat and downward-sloping yield curves as well. Unlike the other two hypotheses, it can explain *why* the yield curve slopes upward. It also suggests, as is borne out by empirical studies, that short-run and long-run interest rates move together in the same direction.

Check Your Progress 3

1) What do you understand by yield curve and by the term-structure of interest rates?

....

....

....

....

....

2) Distinguish between the expectations hypothesis and the market-segmentation hypothesis for the explanation of term-structure.

....

....

....

....

....

3) In what way is the preferred habitat theory of the term-structure of interest rates a combination of, and improvement over the other two theories of the term structure of interest rates?

....

....

....

....

....

4.5 LET US SUM UP

This unit dealt with deterministic cash flows. The fundamental idea behind inter-temporal cash flow is that people have a preference for the present as compared to the future. A rupee today is much more valuable than a rupee tomorrow. This implies that there is a time value of money. The unit explained this in detail, and then went on to discuss the concepts of compounding and discounting. The difference between simple and compound interest was put forward as also compounding, when compounding was done more than once a year. The present and future values of annuities were explained.

The unit then went on to discuss various theories of the determination of the level of interest rates, after a careful discussion of the saving consumption choice with saving seen as deferred consumption. Following this, theories of the explanation of the interest rate were discussed. The unit discussed the classical; the Keynesian; and the loanable funds theories were discussed.

Finally the unit explained the concepts of term structure of interest rates and the yield curve. an attempt was made to explain the structure of interest rates. Three theories, namely, the expectations theory, the market segmentation theory, and the preferred habitat theory, were discussed.

4.6 KEY WORDS

Annuity : A series of equal payments made at regular intervals

Arbitrage : The simultaneous sale and purchase of assets with identical cash flows

Cash Flow : The periodic inflows and outflows of cash

Compound Interest : Interest earned on the interest

Discount Rate : A rate used to discount (usually reduce) future cash flows to express their values relative to current cash values

Internal Rate of Return : The discount rate which sets the Net Present Value of an investment equal to zero.

Simple Interest : The basic interest on the principal amount

Term Structure of Interest Rates : The relationship between yields to maturity of debt securities and the length of time before the securities mature

Yield Curve : It is a graphical representation of the relationship between yield and period of maturity for fixed income investments of the same kind.

Yield to Maturity : the average annual rate of return to a bond-holder who buys a bond today and holds it until it matures.

4.7 SOME USEFUL BOOKS

Alexander, G.J., Sharpe, W.F., *Fundamentals of Investment*, 2nd Edition, Prentice-Hall, Englewood Cliffs, New Jersey. and Bailey, V, J. (1993)

Fabozzi, F.J. (ed.) (2002) *Interest Rate, Term Structure, and Valuation Modelling*, John Wiley and Sons, New York.

Haugen, R.A. (1993) *Modern Investment Theory,* 3rd edition, Prentice-Hall, Englewood Cliffs, New Jersey.

Hirshleifer, J. (1970) *Investment, Interest, and Capital*, Prentice-Hall, Englewood Cliffs, New Jersey.

4.8 ANSWERS/ HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) See section 4.2 and answer.

2) See section 4.2 and answer.

3) See section 4.2 and answer.

Check Your Progress 2

1) See section 4.3 and answer.

2) See section 4.3 and answer.

3) See section 4.3 and answer

Check Your Progress 3

1) See section 4.4 and answer.

2) See section 4.4 and answer

3) See section 4.4 and answer.