Economics of Banking and Finance Markets
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Lecture - 03
Understanding interest rate: Debt market I

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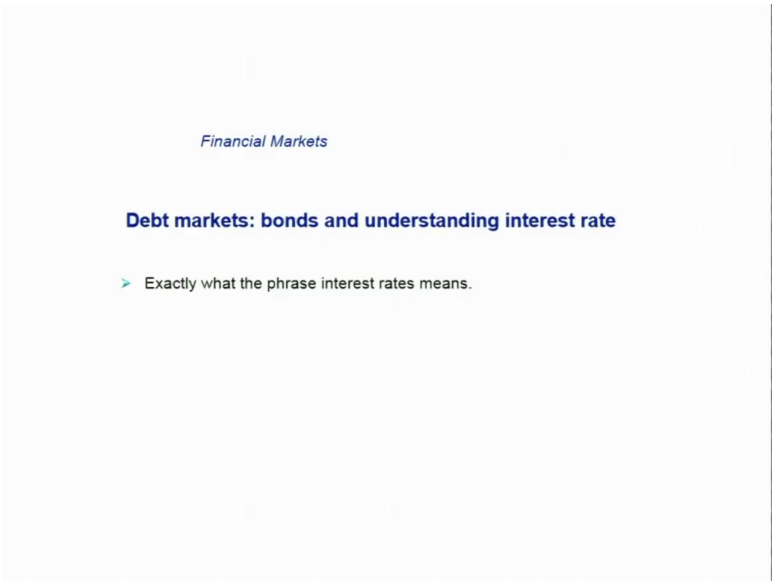

Welcome to this session. In today's session we will focus on Debt markets its main instrument called bonds, and using that, we will understand what exactly the phrase interest rate means.

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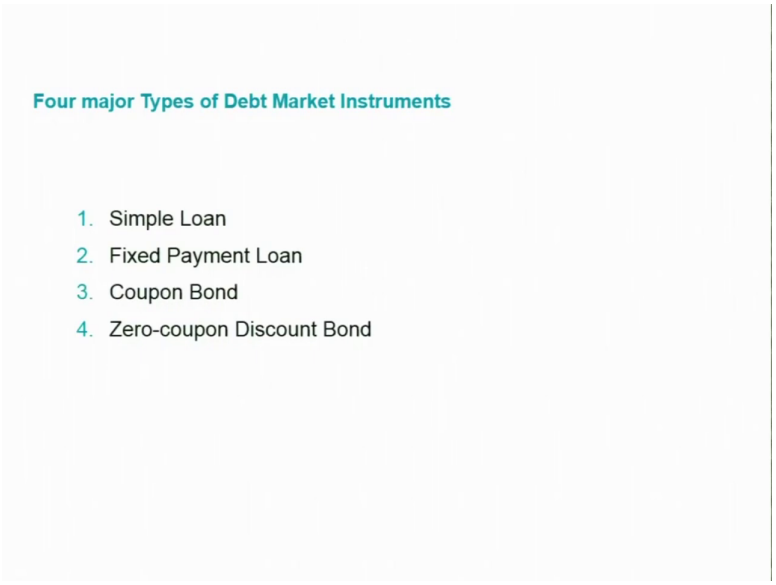

There are four major types of debt instruments. the first one is a simple loan; second one fixed payment loan and third one coupon bond and finally, zero-coupon discount bond. So, let us discuss each of these debt market instruments. one by one.

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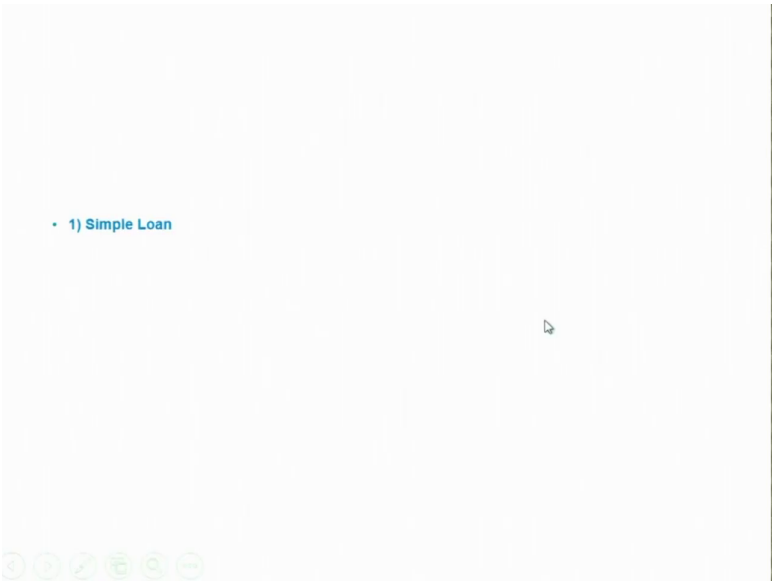

Starting with simple loan. I think you are familiar with this concepts what is meant by simple loan.

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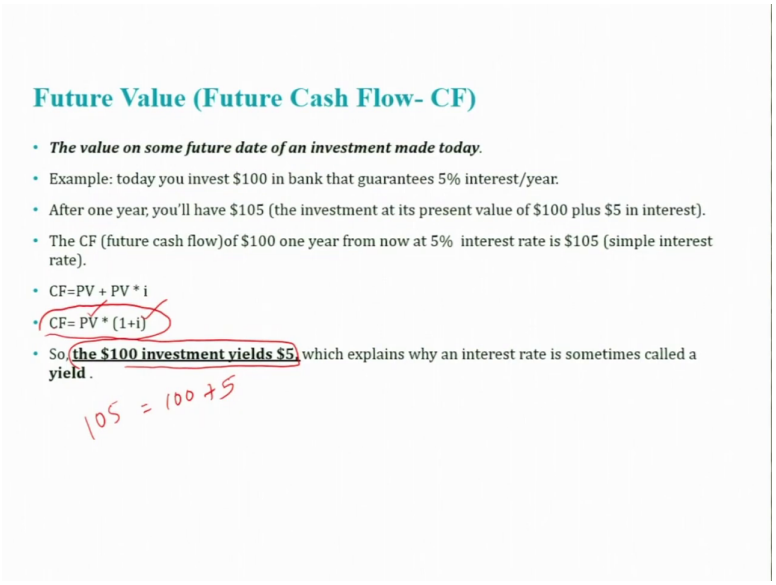

In order to understand simple loan, let us discuss the concept called future value and present value. The present value of some future date of an investment made today. Let us start with an example. Today you invest 100 dollars in bank that guarantees 5 percentage interest per year. After one year, obviously, you will have dollar 105, at its present value of 100 plus 5 dollar 5 as interest. So, here the future cash flow of 100 one year from now at 5 percentage interest rate is 105: at a simple interest rate of 5 percentage.

You can see here that the cash flow is equal to the present value (that is 100) plus the rate of interest. So, you can read it as the cash flow future cash flow is equal to the present value plus 1 plus i. So, here you can see that the present value 100 plus 1 plus i you will be getting the that means, here the 100 investment yields dollar 5.

Cash flow here is 105 so, that is equal to 100 plus 5. This is the basic concepts a very simple explanation of the concept called future value or future cash flow. Thus, using this concept let us further discuss what is meant by present value.

Let us use this as the basic. From this what we are going to say is that when you make an investment of 100 today, your 100 today is equal to 100 and 5 after one year.

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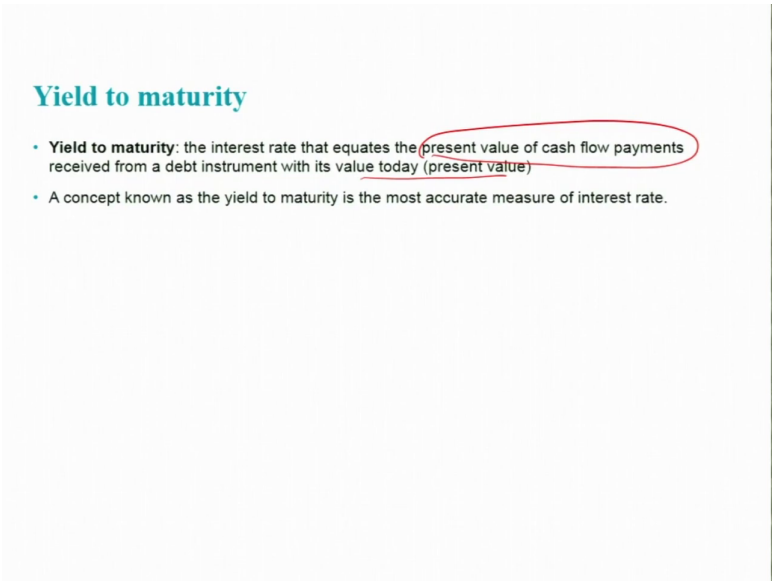

After one year that you are getting payment, we are going to call this payment as yield to maturity. So, in this example we mentioned that the payment that you are getting 100 today is equal to 105 after one year. So, that what equates today's present value of 100 to the future value of 105 after one year is called the rate of interest, and we call it as the yield to maturity.

The yield to maturity is the interest rate that equates the present value of cash flows; present value of cash flows received from a debt instrument with its value today. So, a concept known as the yield to maturity is the most accurate measure of interest rates. In our course whenever we mention interest rate, that the market interest rate, it means the yield to maturity.

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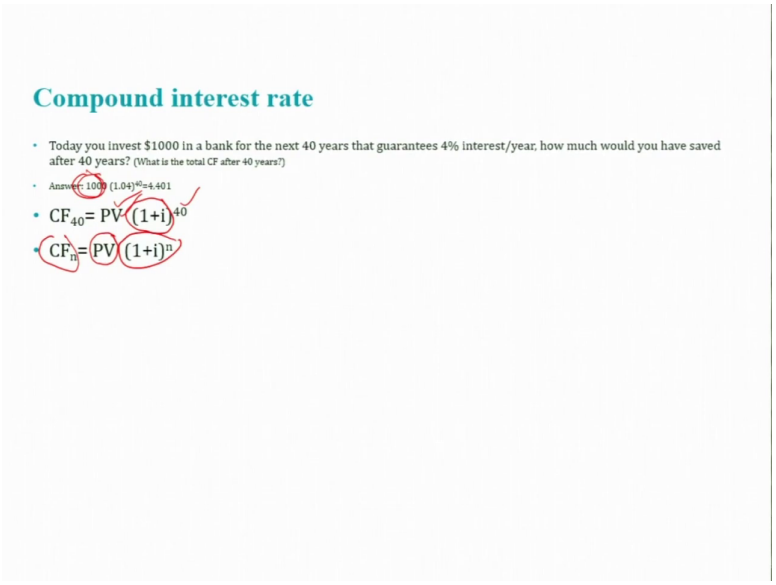

The one we discussed was simple interest rate, let us also discuss compound interest rates. Let us take a simple example; today you invest 1000 dollar in a bank for the next 40 years that guarantees 4 percentage interest per annum and how much would you have saved after 40 years? means, what is the total cash flow after 40 years? How would you calculate this?

If you apply this formula, you will be getting that cash flow after 40 years is equal to present value that is 1000 that is the present value 1000 today, the cash flow after 40 year is equal to present value, times, 1 plus i raise to 40. It means, if there is 'n' number of years cash flow, if you want to calculate the future cash flow after 'n' number of years the formula here is 'PV' that the present value in our example this one is 1000 times 1 plus i raise to 'n'.

This is the formula to calculate the compound interest rate. This concept that we are discussing, later on we will apply in the bond market while calculating the interest rate, and also calculating the present value of a bond as well.

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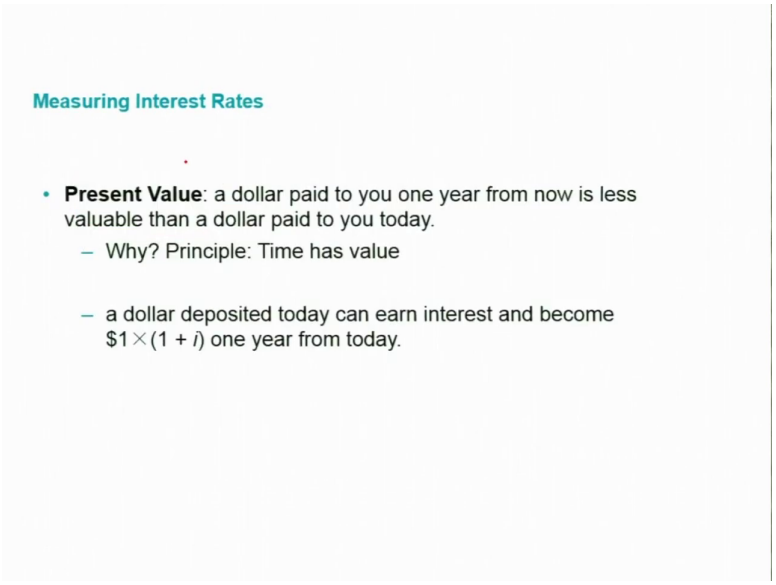

In measuring interest rate, you can see here that the present value concept we talked about. A dollar paid to you one year from now is less valuable than a dollar paid to you today. Why? Because we know that time has value, the principle that we discussed in the previous session, that is, time has value. So, a dollar deposited today can earn interest and become dollar 1 times 1 plus i one year from today; it means, a dollar paid to you one year from now is less valuable than a dollar paid to you today.

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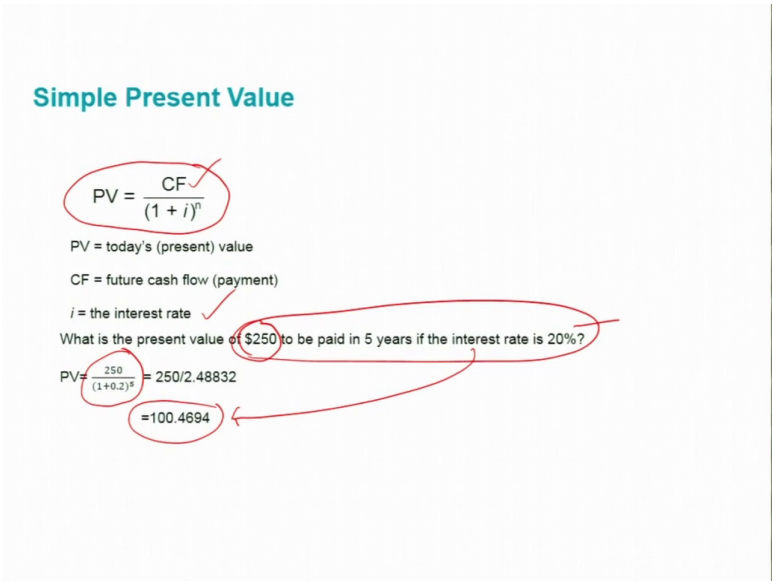

The simple present value from this, if you have been given the future cash flow (in the bond market when we discuss at that time) mostly we will be dealing with the what you are going to get the future payment. The cash flow that may be after 1 year, maybe after 5 years, or after 10 years from that you need to calculate the present value of the bond; that means, the current price of the bond. At that time you need to apply calculate the present value. So, the present value you can exactly put it in this formula you can translate it into present value. Present value is equal to cash flow divided by 1 plus i raised to n. So, PV is the today's, that is the present value of CF (future cash flow), and i is the rate of interest. So, just we are using a numerical example, what is the present value of 250 to be paid in 5 years if the interest rate is 20 percentage? Plugging these values into the formula, you will be getting 100.4694; that means, the present value of 250 to be paid in 5 years when the interest rate is 20, the present value of this payment is 100, this present value of this payment is 104 100.4694. So, putting in stating in another words. So, if you invest 100.4694 today after 5 years at a rate of interest of 20 percentage you will be getting the future cash flow of 250 dollar.

The basic concept that we are discussing here will be later applying while understanding current price of bonds and as well as the rate of interest calculation etcetera.

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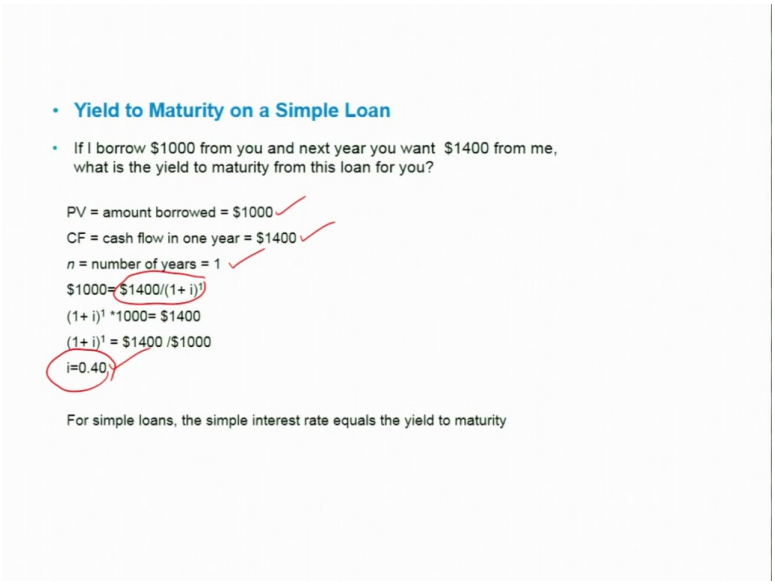

Yield to maturity on a simple loan: let us apply this concept to understand in calculating yield to maturity on a simple loan. Suppose if I borrow 1000 from you and next year you want 1400 from me and, in this case, what is the yield to maturity from this loan for you? You

know that here the present value or the that is the borrowed amount is 1000 and cash future cash flow is 1400 number of years is 1. Plugging this values in the formula, you will be getting this one, then finally, when you translate this one to calculate, you will be getting the rate of interest as 0.4 that is the 40 percentage; 40 percentage is the rate of interest here. So, for simple loan simple interest rate equals the yield to maturity.

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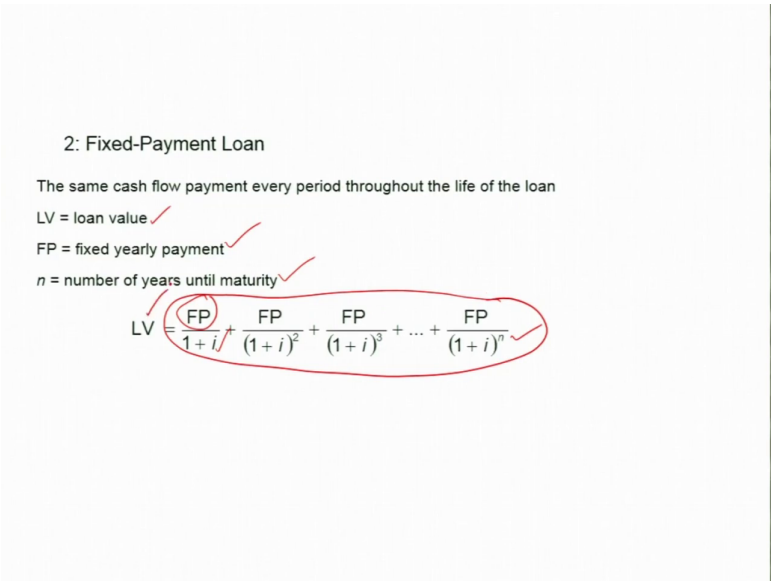

After discussing the simple loan let us now move to simple payment loan this also called as EMI: Equal Monthly Instalment. Suppose in this case the same cash flow payment every period throughout the life of the loan. Here, the formula in order to calculate this the loan value is: suppose LV is the loan value and FP is the fixed yearly payment or you can also call it monthly payment as well.

Let us call it, for the time being, fixed yearly payment and the number of years until maturity. You can calculate the loan value using this formula; that means, the n number of years because the fixed yearly payment that you will be making this one. then what is the rate of interest agreed rate of interest; then plug values in this formula, then you will be getting the present loan value.

Since we just briefly discussed the simple loan and fixed payment loan, the intuitive idea that we got from here can be applied in the bond market to understand the rate of interest there and the present value of a bond. Before applying this concept there, let us see what is meant

by bond. There are mainly two types of bonds: coupon bond and zero-coupon discount bond. So, let us understand what is meant by bond.

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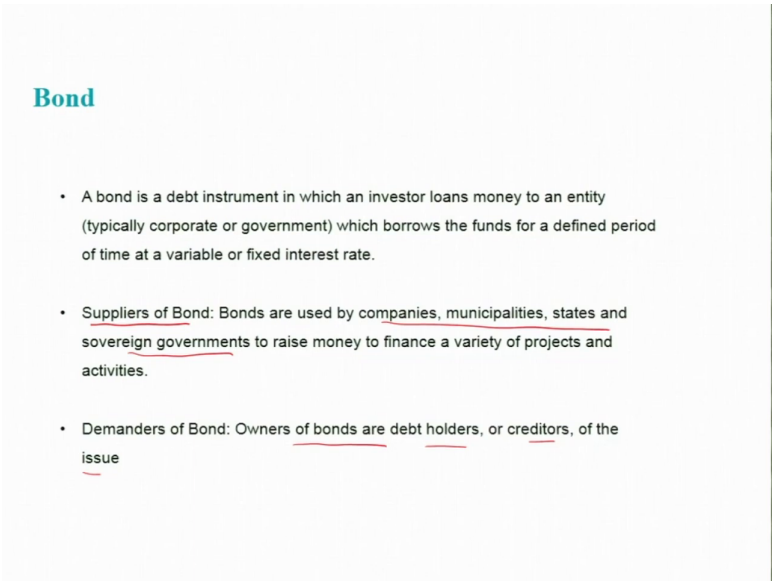

A bond is a debt instrument in which an investor loans money to an entity typically to corporate or government which borrows the funds for a defined period at a variable or fixed interest rate. This is one of the debt instruments. In the bond market, there are suppliers and demanders.

The suppliers of bonds; bonds are supplied by companies, municipalities, states, and sovereign governments to raise money to finance a variety of projects and their business activities; they are the suppliers of bonds in the market. Who are the demanders of bonds? Demanders of bonds are those people who have assets or fund who want to invest in the finance market. They are the owners of the bonds or creditors, and they are mostly households and banks. We will see in the appropriate contexts in the subsequent sessions that who are the demanders of bonds.

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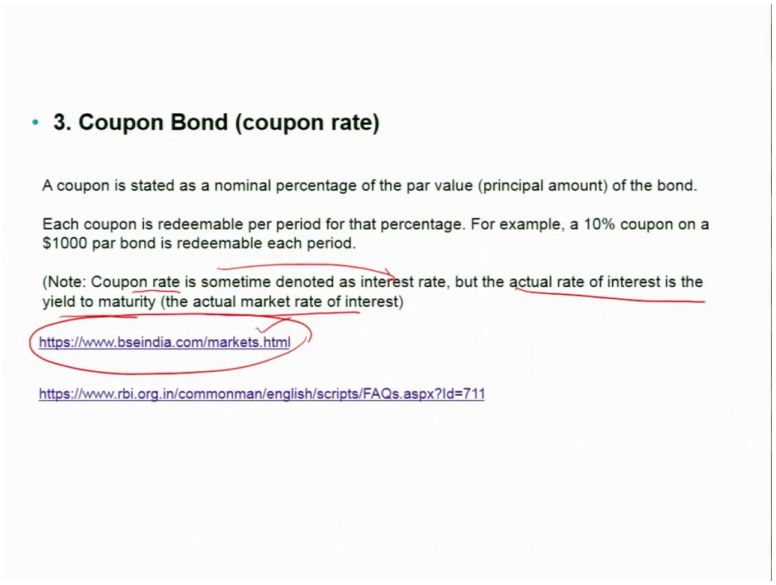

As I mentioned just before, there are mainly two types of bonds, one is called coupon bond--the bonds issued at a coupon rate. So, a coupon is stated as a nominal percentage of the par value or the principal amount or the face value of the bond. So, each coupon is redeemable per period for that percentage; for example, a 10-percentage coupon on a 1000 per bond is redeemable each period.

Here I just want to bring your attention into one of the issues, the coupon rate is sometime denoted as interest rate, but some time in many newspapers including business daily they denote it as interest rate interchangeably. But the actual rate of interest that we are going to discuss in this course is not coupon rate, coupon rate is the payment that you will be getting regularly once you hold buy a coupon bond. But the rate of interest is the yield to maturity, this is the actual market rate of interest, which will be determined by demand for and supply of bonds in the market. So, you do not get confused with a coupon rate as interest rate as these both are different concepts.

I would suggest you visit one of the stock markets, maybe for example, BSE and when you visit the markets part there you will be seeing equity market and debt markets. So, you click the debt market component and then you can see that you will get lots of information about the bond, and there you can also see different coupon bond and zero-coupon bond etcetera. And I would also suggest you visit RBI website as well, RBI has given a detailed description,

in very simple user language, what is meant by bond, what are different types of bond, and how this has been traded in India, etcetera.

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So, a coupon bond, it looks like this, I have taken it from the internet. You can see here for example; this one was issued by 'Reading Company'. You can see what is on the bottom: each of them is the coupon. This is a 1000 face value 50 year 3 and a half percentage 3.5 percentage coupon bond issued on May 1st, 1945. This one is coupon; that means, on every agreed period the holder of this bond will be getting this coupon value, that means, 3.5 percentage.

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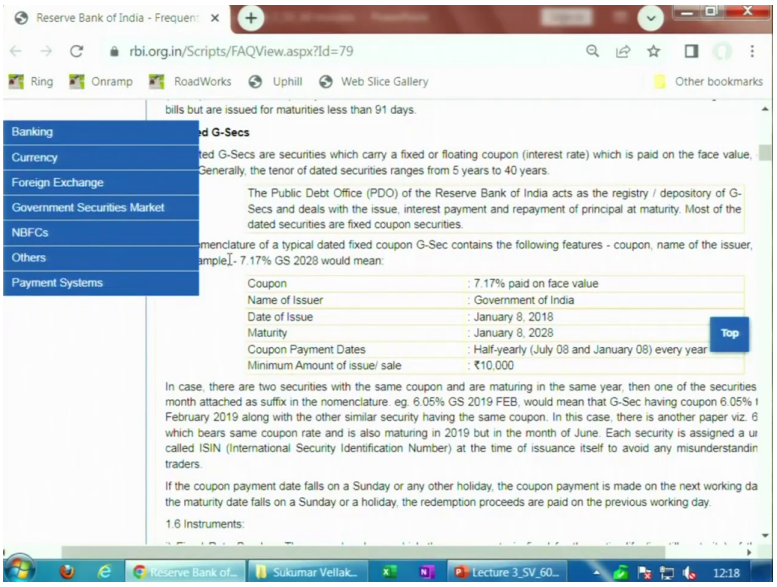

To understand more about different types of bonds or the coupon bonds.

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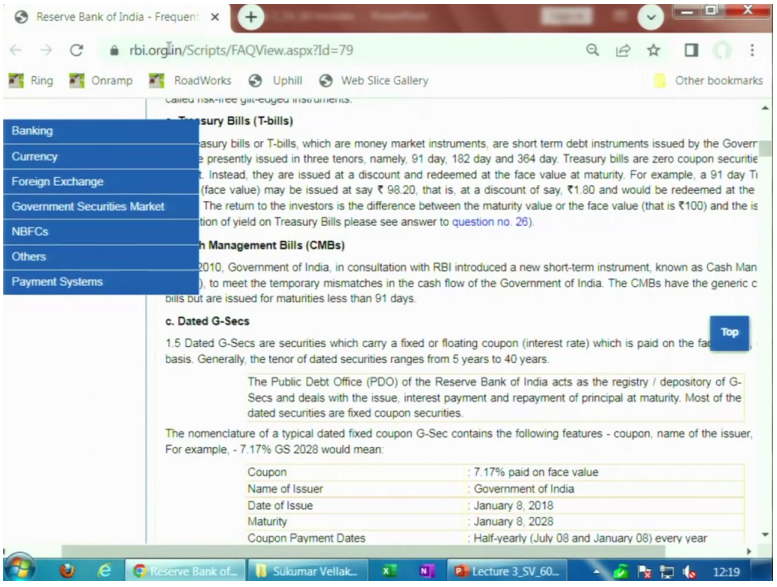

This is in the RBI website. RBI website has clearly explained it. It has a clear-cut explanation of different types of bonds. There is one called' dated securities; that is dated bonds, these are securities which carry a fixed or floating coupon interest rate. And the coupon is paid on the face value on a half-yearly basis.

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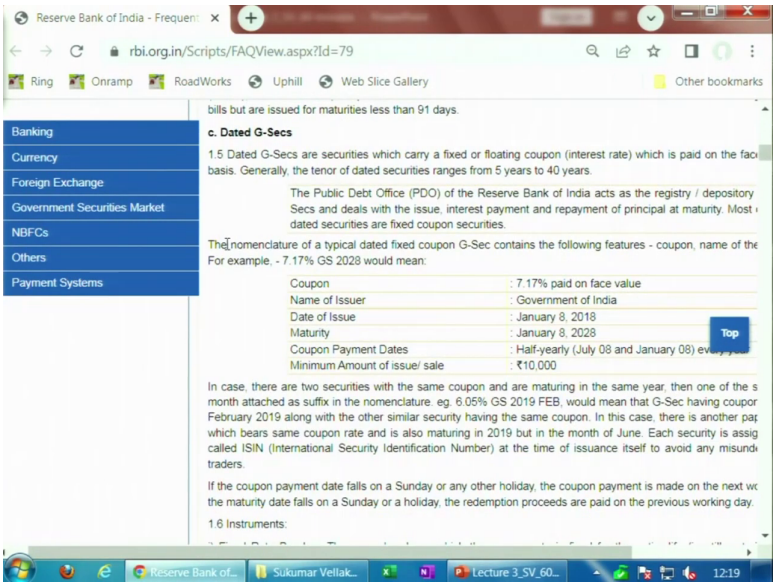

Generally, the tenor dated securities ranges from 5 years to 40 years. You know for a typical dated fixed coupon government securities contain the following features; that means, coupon name of the issuer, date of issue, maturity, coupon payment dates that is half-yearly minimum amount issue etcetera. So, there are two securities with the same coupon and are maturing in the same year.

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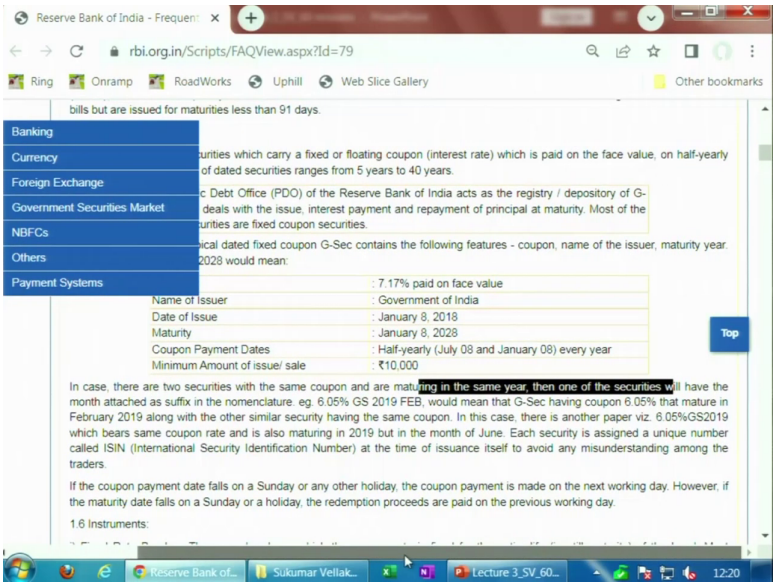

So, in this case there are two securities with the same coupon and maturing in the same year. One of the securities will have the month attached to suffix the nomenclature that is six point, zero five percentage GS 2019 Feb. So, I would suggest you visit this website (RBI website).

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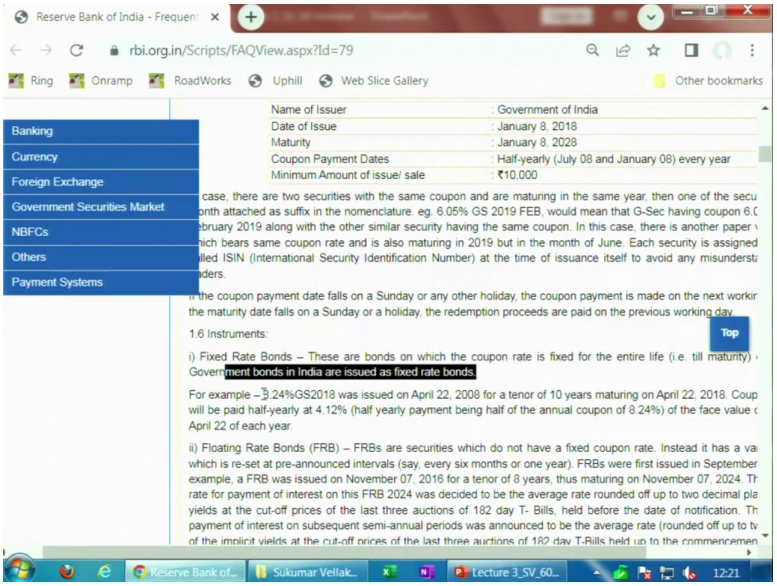

In the instrument as I mentioned, one is called fixed rate bonds. These are bonds on which coupon rate is fixed for the entire life till maturity of the bond. Most government bonds in India are issued as fixed rate bonds. For example, you may read in the economic dailies, economic times or financial express that means 8.2 percentage 24 percentage GS government securities 2018 was issued on April 22, 2008 for a tenor of 10 years maturing in on April 22, 2018.

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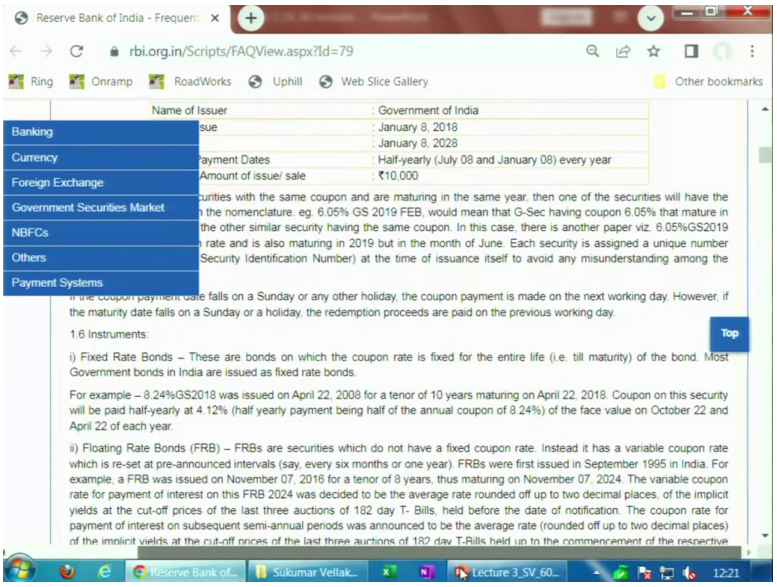

Here, the coupon on the securities is fixed and will be paid half-yearly at 4.12 because the coupon rate here is 8.24 percentage for annual. It means, every half-yearly you will be getting 4.12 percentage of the face value in October 22nd and April 22nd each year. So, this is fixed rate bond, that is, fixed rate coupon.

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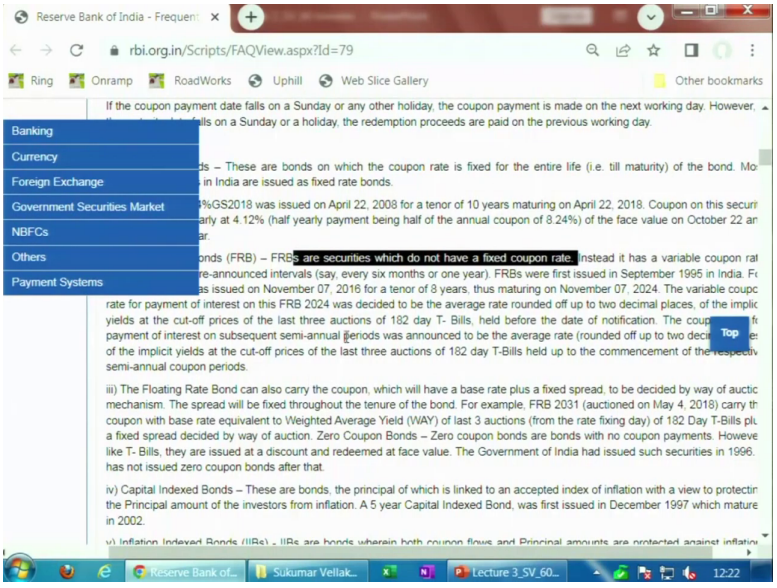

And another coupon is floating rates; FRB in short. The FRBs are securities which do not have a fixed coupon rate, instead it has a variable coupon rate which is set at pre announced intervals. Yyou please go through this website and get to know more about these aspects.

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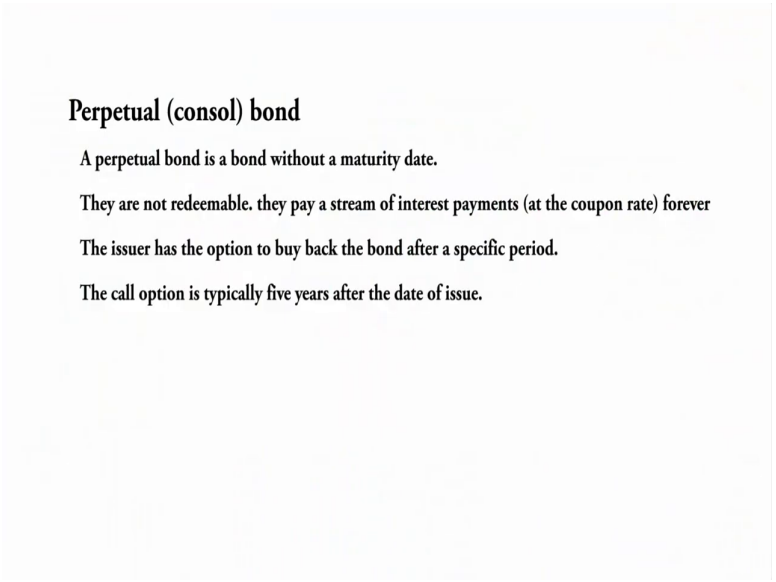

There is also perpetual bonds; a perpetual bond is a bond without a maturity date, these are not redeemable; they pay a stream of interest payments at the coupon rate forever. This also call it as perpetuity; that means, there is no maturity date for this kind of bonds.

These are redeemable and they pay a stream of interest payments forever. The issuer has the option to buy back the bond after a specified period. The call option is typically for 5 years after the date of issue.

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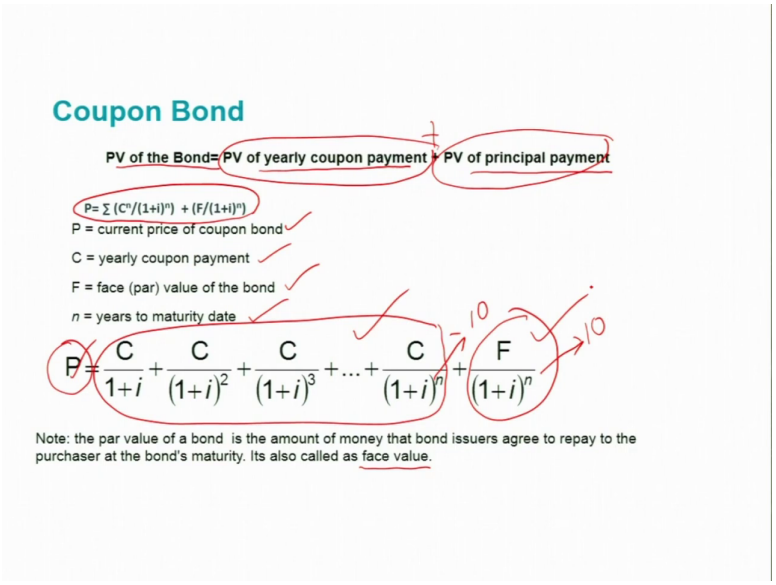

How to calculate the current price of a bond of a coupon bond? Suppose if you are given the face value of the bond, and how in this case, the yearly coupon payment also given. In this way we can calculate the present value of the bond. The present value: simply to start with, the present value of the bond is equal to present value of yearly coupon payment plus present value of principal payments.

This is the formula for calculating the present value of the bond; that means, the current price of the bond. Suppose if you want to calculate the current price of the bond that the price of the bond, not always necessary to say current price, P the price of the bond we can calculate by using this formula.

The P, that the current price, the coupon payment C means yearly coupon payment, F is the face value or par value of the bond 'n' is the years to maturity date. For example, in the case when we mention the RBI bond that is for 10 years; year to maturities is 10; we can plug it in the formula.

If this for 'n' number of years; if it is for 10 years, we calculate it for 10 years starting from first to second third like that n number 10 years; then we also calculate what is the present value of principal payment; that means, this one the 'n' number of years or suppose in the case of RBI 10-year bond, you can calculate it for 10 years. So, the par value of a bond is the amount of money that bond issuers agree to pay to the purchases at the bond's maturity, and it is also called as face value.

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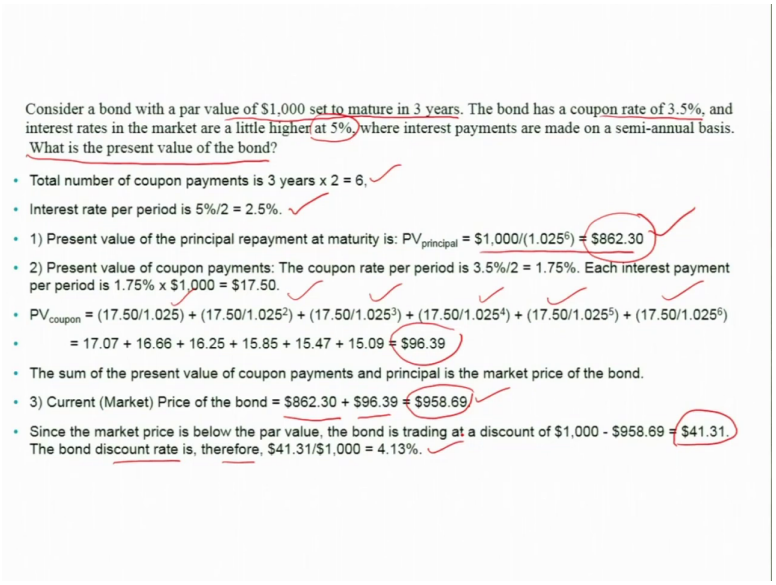

Let us calculate the price of a bond using a numerical example. Consider a bond with a par value of 1000 set to mature in 3 years. The bond has a coupon rate of 3.5 percentage and interest rates in the markets are little bit higher at 5 percentage, suppose and interest payments are made on a semi-annual basis.

Based on this information what is the present value of this bond. Let us start with given information; let us start calculating the price of the bond, that is the present value of the bond. From this information you can see that the total number of coupon payments is 3 years times 2 that is 6, means the total number of coupon payment is 6, interest rate per period is 5 percentage divided by 2, that is 2.5 percentage, annual rate of interest is 5 percentage, but the coupon payment is made on a semi-annual basis.

So, interest rate per period is 2.5 percentage. The present value of the principal repayment at maturity is the 'PV' (the present value) of the principal amount. So, when you use the appropriate formula, you will be getting this value; that means, the present value of the principal repayment at maturity is dollar 862.3.

What is the present value of the coupon payments? The stream of payment that is happening for 3 years. So, here the present value of the coupon is: this plus this plus this plus this plus this because of 6 period. So, you will see that, for the present value of the coupon that you will be getting in every semi-annual basis for the next 3 years is going to be this much.

From this you can see that the present value or the current price of the bond that the price of the bond is the coupon payment the present value of the coupon payment this plus this. We have calculated this here; we can see here that actually the present value (the sum of the present value of coupon payment and principal) is the market price of the bonds.

Here you are summing the current price of the bond, that is, the price of the bond is 862.3 plus 96.3 is equal to this, this is the current price of this bond. So, from this information the bond with a par value of 1000 set to mature in 3 years which has a coupon rate of 3.5 percentage and when the current rate of interest market rate of interest is 5 percentage. Then the current value or the price of this bond is 958 plus 69. So, this is the way to calculate the price of bond. Since the market price is below the par value, the bond is trading at a discount of 441.31. That means, this bond is a discount bond, the bond is trading at a discount. You can also calculate the bond discount rate, here the bond discount rate is 4.13 percentage.

Let us now move to the next type of bond that is called zero-coupon discount bond.

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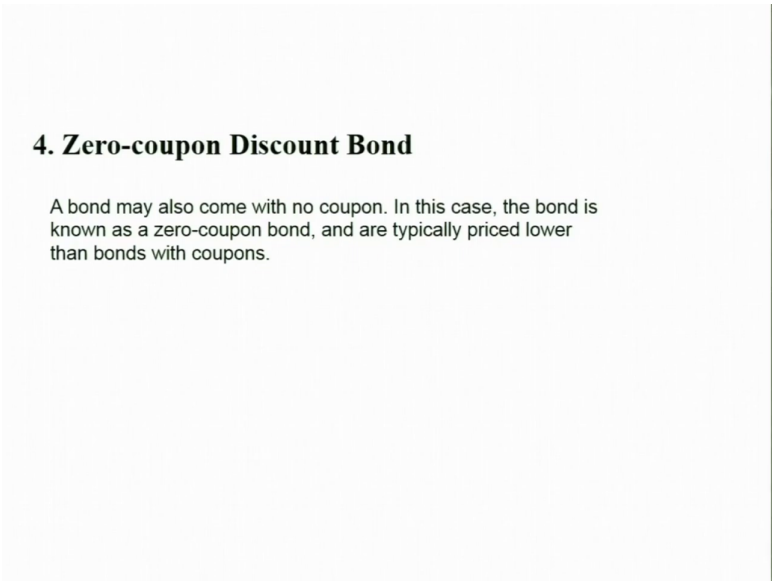

What is mean by a zero-coupon discount bond? A bond which comes with no coupon. In this case the bond is known as a zero-coupon bond, and are typically priced lower than the bonds with the coupon because the bond is not coming with any coupon payment at all.

Suppose if you buy a zero-coupon bond this year, you will not be getting any coupon instead you will be getting only the face value after one year.

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Look at this, this is an example I have taken from the internet. You can see here that this is a zero-coupon discount bond. You can see here that the issue date is October 1969. And this zero-coupon bond is due and payable on April 9th, 1970; that means, after the maturity date the holder of this bond will be getting exactly this amount 100000.

It means, when this was traded on October 9, 1969 this was traded at a discount; that means, obviously, because the person has to get the return as well the interest income. So, this will be traded at less than the par value of 100000.

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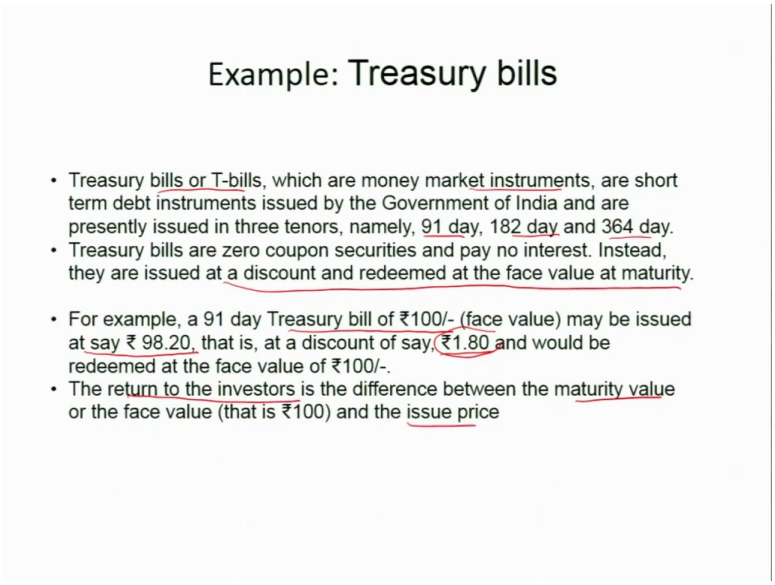

An example for a zero-coupon payment in India is the treasury bill. The treasury bills which are denoted as T bills, which are money market instruments, are short term debt instruments issued by the Government of India, and are presently issued in three tenures, namely, 91 days, 180 days, and 364 days. Treasury bills are zero-coupon securities and pay no interest, instead they are issued at a discount and redeemed at the face value at maturity.

For example, a 91-day treasury bill of 100 rupees face value may be issued at say 98.20 , that is, at a discount of say 1.88 and would be redeemed at the face value of 100. So, this discount is the interest income. The return to the investors is the difference between the maturity value or the face value and the issue price, that is the return to the investors, that is the difference between the maturity value and the issue price.

In the next session we will continue this discussion.

Thank you.

Key words: interest rate; yield to maturity; present value; future cash flows; simple loan; fixed payment loan; face value; coupon bond; zero-coupon discount bond.