Course Description: This course covers major topics in fixed income securities. The emphasis of this course will be on valuation. The course will tend to be quite quantitative. The area of fixed income comprises of study of bonds, bond derivatives, interest rate derivatives, interest rate swaps, mortgage and asset backed securities. We will be focusing principally on interest rate risk and valuation of these instruments. Towards the end of the course, we will briefly touch on credit risk.

Prerequisites: You should be able to use excel spreadsheets for analyzing data. A lot of the course will be excel based. I will assume that you are familiar with standard finance paradigms such as efficient markets and concept of arbitrage. If you have forgotten these, it is your responsibility to revise these on your own. You should have taken one basic finance course and one course in Investment Analysis or equivalent.

Required materials: Course notes posted on IVLE. No paper copies will be handed out. It is the responsibility of the student to download the notes prior to the lecture.

Recommended texts: Fixed Income Securities, by Bruce Tuckman

Grading:

Problem sets/projects/cases: 25%
Students may work for these assignments in groups of up to 4 students. Assignments are generally to be submitted via IVLE unless explicitly stated otherwise in the given assignment handout. No extra credit will be given if you form a smaller group.

For cases, assessment will be based partly on your level of participation when the case is discussed in class and partly on your case report. Thus, the default expectation is that you will have read the case carefully prior to the class when it is scheduled to be discussed. In classes when a case is scheduled to be discussed, you will have to sit along with your group members.

In class tests: 50%
There will be 2 in class tests, each worth 25%.

Final project: 20%
You will have a final project or case study assigned in the last class. This will also be a group project.

Attendance: 5%
You will lose 1% percent per lecture you do not attend subject to a maximum loss of 5% (which corresponds to a total absence of 5 lectures). You can miss lectures without losing the attendance grade for the following reasons. For each reason, the accompanying documentation that will be required in order for you to get credit for the missed class or classes is also mentioned.

1. Sickness or injury: A certificate given by a medical practitioner that clearly states the time period for which absence is necessary. This to be provided within 1 week of last missed lecture.
2. Family bereavement: Letter from parent/guardian stating the nature of the bereavement with their contact details; instructor to be notified within two weeks of last missed lecture.

3. Job interview: Letter/e-mail from interviewer confirming venue, date and time; instructor to be notified in advance of the interview.

*If you miss 6 or more lectures without appropriate reasons as stated above, I may fail you in the course independent of your performance in other components of the assessment.*

**Late submission of problem set/project/case and missed in-class test policy:** Late submissions of assignments or late/early test taking will not be accepted except when the late submission or late/early test taking is due to any one of the three mitigating circumstances as given above in the attendance section. In case the solution to the given test or homework has been discussed in class, instructor will provide either provide a make up test or assignment or add the credit to another component of the grade depending on the particular situation.

**Policy for group work**

All members in a group will get the same grade for the given case or assignment. You can have different group members for different assignments or cases and you can freely change group members. I will not adjudicate on any disputes within groups.

**Consultation Hours:** By prior appointment only.

**Course Contents (tentative list – subject to change)**

1. **Overview**
   - Features of bonds
   - Risks associated with bonds
   - US treasury bonds and Auctions
   - Agency bonds
   - Corporate Debt
   - Municipal Bonds
   - Stripped Bonds
   - Mortgage backed securities
   - Floating Rate Securities
   - Interest Rate Swaps
   - Futures
   - Options

2. **Zeros and Coupon Bonds**
   - Framework for pricing
   - Quotation conventions
   - Accrued Interest conventions
   - Zero Discount factors
   - Synthesizing of zeros from coupon bonds
   - Synthesizing of coupon bonds from zeros
   - Relation between discount factor and semi-annual rate
   - Valuation of a stream of cash flows in terms of zero rates

3. **Spot rates and forward rates**
Definition of spot rate and forward rate
Calculation of synthetic forward rate
Calculation of forward price
Spot rates as an average of forward rates
Forward rates versus future spot rates

4. Yield of a bond
Yield measures – Current Yield, Yield to maturity, yield to call, yield to put, yield to worst
Price-yield formula for bond on coupon date
Definition of term structure
Illustration of Pull to Par effect
Illustration of the Coupon effect
Differences between yield and rate of return
Definition of par rate
Extracting yield curves in practice
    Singapore Government Yield curve
Going from the yield curve to the par rate curve
Going from the yield curve to the forward rate curve
Problems with linear interpolation of yield curves

5. Interest rate risk – Duration
Price rate function of a zero
Meaning of a change in the interest rate
Dollar Value of a basis point
Special cases of DV01 for zeros, coupon bonds, consols
Dollar duration
Dollar duration of a portfolio
Duration
Modified duration
Duration of a portfolio
Modified duration of a portfolio

6. Interest rate risk - Convexity
Convexity correction as the second order derivative
Dollar convexity of a portfolio
Convexity of a portfolio
Barbells and Bullets

7. Immunization
Hedging Interest rate risk
    Dedication
    Immunization by duration matching
    Immunization by duration and convexity matching
    Immunization by key rate hedging
    Excel project on immunization using all methods

8. Floating rate bonds & Swaps
Floaters and Inverse floaters
Valuation
Interest Rate sensitivity
Interest Rate Swaps
    Uses
    Valuation
    Interest rate sensitivity
Swap spread
Credit risk in swaps

9. No arbitrage pricing
   Introduction to the binomial model
   State contingent prices
   Risk Neutral probabilities
   Relation between true probabilities and risk-neutral probabilities
   No arbitrage in a multi-period setting
   Dynamic replication
   Pricing of bond options using dynamic replication

10. Modeling of interest rates
    Constructing an interest rate tree based on observed prices
    Equilibrium modeling of interest rates
        Effects of expectation and uncertainty
        Convexity effect
        Risk premium
        Continuous time versus discrete time
    Models of interest rates
        Normal
        Normal with drift
        Lognormal
        Ho and Lee model
        Original Salomon Brothers model
    Hedging of interest rates
        Hedge ratios
        Interest rate delta
        Option delta

10. European and American Options
    Black model
    Valuation of an American Call
    Optimal Exercise policy

11. Callable bonds
    Valuation

12. Swaptions
    Receiver swaption
    Payer swaptions
    Cancelable swaps

13. Mortgages
    Types of mortgages
    Calculation of monthly interest payments
    Valuation of non-prepayable mortgage
    Valuation of prepayable mortgage
        Deterministic prepayment
        Optimal prepayment
        Path-dependent prepayment
    Valuation of Mortgage backed securities
        Interest only
        Principal only
Collateralized mortgage obligations
Planned amortization class bonds
Excel project on valuation of mortgages by various methods

14. Caps and floors
   Valuation
   Interest rate risk
   Capped floater
   Caps and inverse floaters
   Interest rate collars

15. Miscellaneous (not to be covered in detail)
   Repos
   Altman model
   Merton model
   Credit default swaps

16. Integrative project of case study.